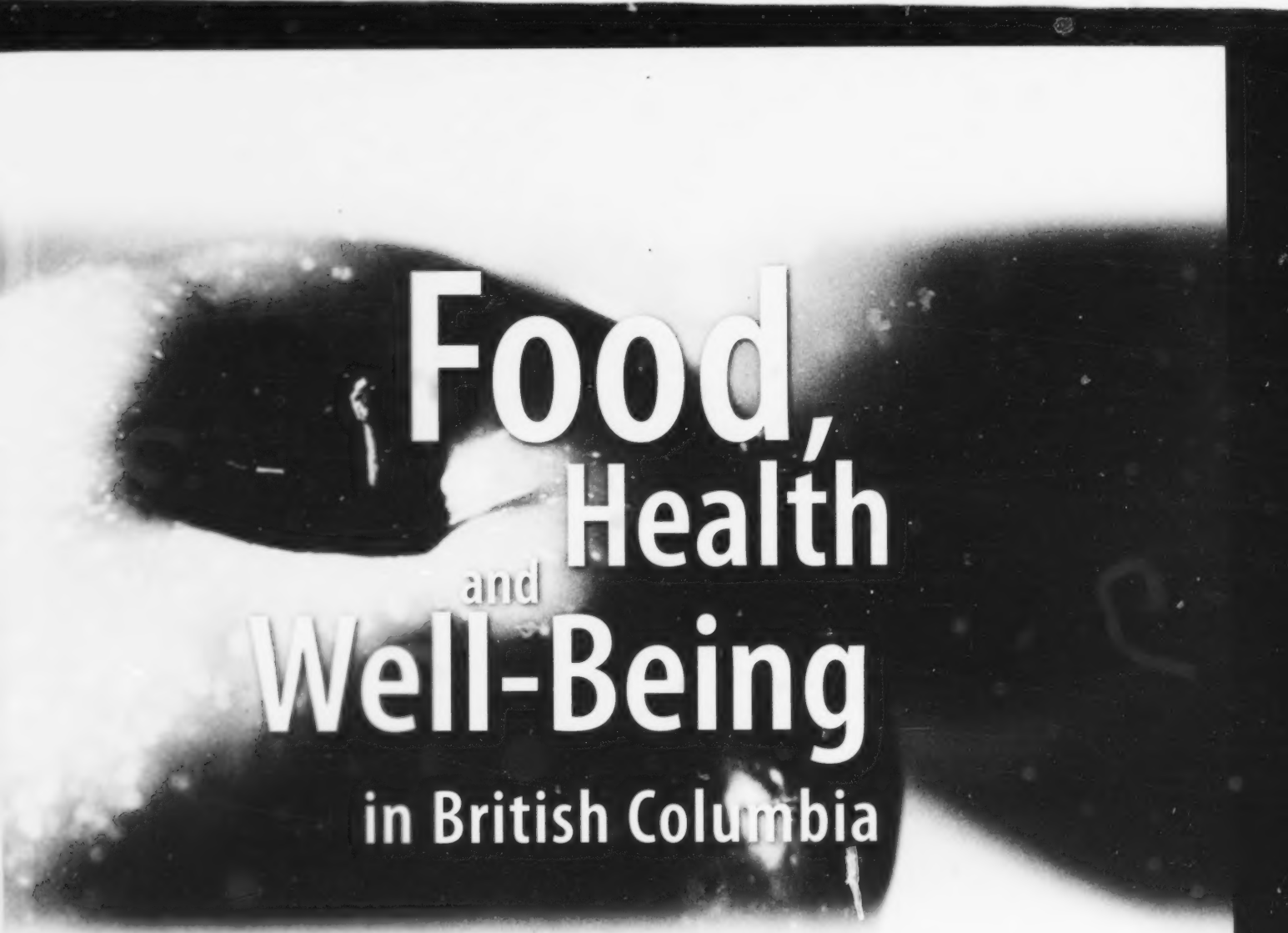

Food, Health and Well-Being in British Columbia

Provincial Health Officer's Annual Report 2005

BRITISH COLUMBIA

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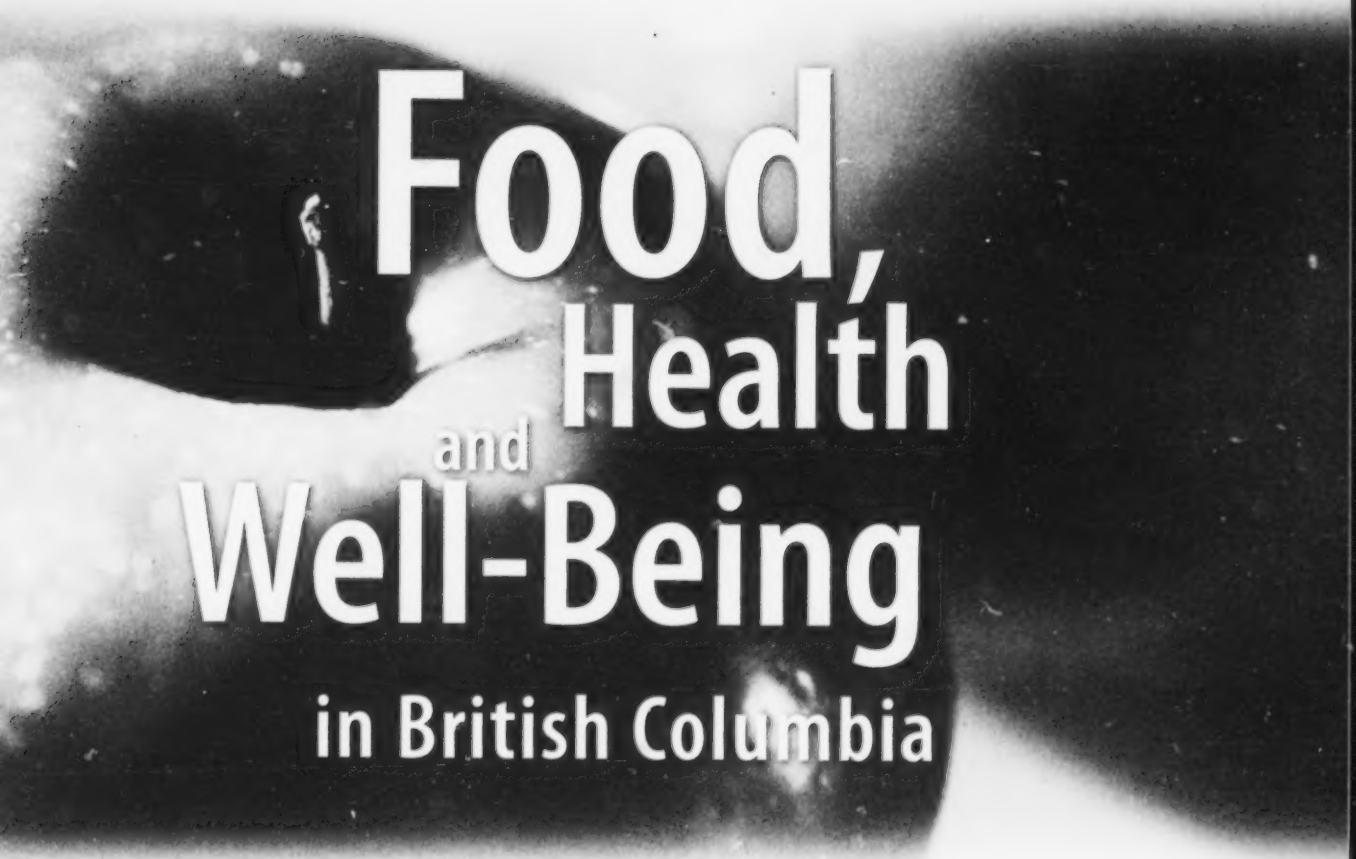


Food, Health and Well-Being in British Columbia

Provincial Health Officer's Annual Report 2005

BRITISH COLUMBIA

Office of the
Provincial Health Officer

Ministry of Health

Victoria, BC

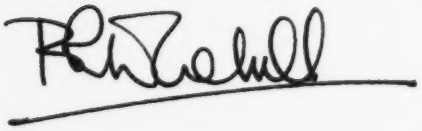
September 26, 2006

The Honourable George Abbott

Minister of Health

Sir:

I have the honour of submitting the Provincial Health Officer's Annual Report for 2005.



P.R.W. Kendall, MBBS, MSc, FRCPC

Provincial Health Officer

2007-01612/

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Highlights

Food is a prerequisite and a determinant of health. The consumption and access to food is related to a complex food system that includes production, processing, distribution, availability, and affordability. All of these interrelated components can work to either support or interfere with the access and affordability of healthy food choices for populations. Any barrier, break, or weakness along the food system can undermine the ability of the population to access safe, nutritious food, which can then undermine their health and wellness.

In 1996, the World Food Summit defined food security as the following:

> ***Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy lifestyle.***
>
> *(Food and Agriculture Organization of the United Nations, 1996).*

Any food system is an economic and political creation. An optimally nourished population depends on a healthy, sustainable food system that is influenced by the political and economic processes of policies, programs, markets, and services. The influence of these processes impacts the production, processing, distribution, marketing, acquisition, and consumption of food. These in turn shape the individual, family and community, and the environment, agriculture, and education.

Nutrition and Health

A substantial number of people in British Columbia, while not food-insecure, are considered to be "malnourished", either through overconsumption of foods that should be consumed in moderation, or through underconsumption of nutritious food, or both. The 1999 BC Nutrition Survey showed that 65 per cent of those surveyed were not consuming the minimum of 5 servings of vegetables and fruits per day, and that 25 per cent of respondents consumed more than 35 per cent of their total calories from fat (Ministry of Health Planning [MOHP], 2003).

Despite the complexities of food and nutrition, it is now clear that poor food choices can be a significant risk factor for chronic disease. In 1988, the United States Surgeon General's *Report on Nutrition and Health* estimated that two-thirds of all deaths in the United States were due to diseases that had some association to diet (United States Department of Health and Human Services, 1988).

In 2004, as with previous years, malignant neoplasms (cancer) and cardiovascular disease were the leading causes of death in British Columbia (28 per cent and 23 per cent respectively) (British Columbia Vital Statistics agency, 2005). There is solid evidence that over 50 per cent of different types of cancers and a large proportion of cardiovascular disease could be prevented through behavioural and environmental changes (WHO, 2003b).

Research has shown that one-third of all cancers could be avoided by eating more fruits and vegetables and whole

grains, minimizing saturated fats and trans fats, maintaining a normal weight, and exercising regularly. Obesity itself is strongly related to a large number of cancers, with estimates that 14 per cent of all deaths in men and 20 per cent of all deaths in women from cancer could be attributed to the current patterns of obesity in North America (Calle, Rodriguez, Walker-Thurmond, & Thun, 2003).

In 2004, (based on Statistics Canada's Community Health Survey) 23 per cent of adult Canadians were obese, with BMIs of 30 or greater, compared to 14 per cent in 1978/1979. BC has the lowest rates of obesity in Canada; nevertheless 19 per cent of the adult population in BC is considered obese, with BMIs over 30. British Columbia had more people who were overweight than all other provinces except Prince Edward Island. Both provinces had an overweight rate of 40 per cent. The overall rate of overweight adults in Canada was 36 per cent.

The obesogenic environment, which is defined as "the sum of influences that the surroundings or conditions have on promoting obesity in populations" (Swinburn, Egger, & Raza., 1999), has brought changes in eating patterns and physical activity that underlie the obesity epidemic. It is through environmental modification that this epidemic can be reversed.

In 1997, the World Health Organization Consultation on Obesity recommended the necessity for comprehensive public health approaches and strategies for the prevention and management of overweight and obesity (World Health Organization [WHO] 2000). These strategies aim to change the physical and social environments responsible for the increasing trends in overweight and obesity by intervention in the following areas:

- Health-promoting school environment
- Public education
- Monitoring and regulation of the marketing approaches of the food industry
- Urban design and transportation
- Data and research

Food Insecurity and Access to Nutritious Food

A healthy food system is essential to support healthy food choices. In British Columbia, for the most part, the majority of the population has ready access to a wide variety of healthy food choices. However, certain groups, such as those on low income, have challenges in affordability and accessibility to healthy foods. For those living in rural and remote communities, the above issues are compounded by limited or expensive transportation of healthy foods to their rural communities, as well as transportation barriers within the community to local food sources. Overall, declining farmland, reliance on imported food, and the inability for certain populations—most notably low-income British Columbians—to access safe, nutritious, and sufficient food, all contribute to food insecurity in the province.

The level of food insecurity in BC is above the national average and is cause for concern. In 2001, about 17 per cent of BC's population could not afford the quality or variety of food they wanted, worried about not having enough to eat, or had not had enough to eat at some time in the previous 12 months. The national average was 15 per cent in the same year. BC's lower and lower-middle income households were most likely to have food insecurity, with 30 per cent of those households reporting at least one instance in the previous year of not having had enough food to eat (Ledrou & Gervais, 2005).

Individuals in food-insecure households in Canada are more likely to report ailments such as heart disease, diabetes, and high blood pressure (Vozoris & Tarasuk, 2003). Once a chronic health problem appears, it is challenging for those on low incomes to follow dietary recommendations for their illness, such as a low-sodium diet for high blood pressure, or a high-fibre, low-fat, low-added sugar diet for diabetes. Such special diets often cost more than the basic diet. For example, a diabetic diet costs about $60 more per month than the 2005 BC basic food basket (Anderson, McKellar, & Price, 2006).

Children in hungry households in Canada are reported to have significantly poorer health than other children (McIntyre, Connor, & Warren, 1998). Almost 30 per cent of children in food-insufficient households suffer from asthma, compared with 13.5 per cent of children in food-secure households (McIntyre, Walsh, & Connor, 2001). Insufficient nutrition during early childhood can cause permanent

cognitive damage, affecting a child's ability to learn and function (Community Nutritionists Council of BC, 2004). American studies have documented chronic minor health problems among children from food-insecure households that include fatigue, irritability, dizziness, recurring headaches, frequent colds and infections, and difficulty concentrating (McIntyre et al., 2001). In adolescents, food insufficiency has been linked to low-level depression and suicide symptoms (Alaimo, Olson, & Frongillo, 2002).

Factors affecting the ability to afford nutritious food in BC include higher costs of a basic "market basket" of items, higher housing costs, inadequate social assistance rates, increased levels of homelessness, and a minimum wage level that can result in even full-time workers in some BC communities falling below the federal low-income cut-off.

A collaborative effort at the community, provincial, and national level is needed to address the underlying cause of household food insecurity—poverty. Individuals, communities, and governments need to support food security initiatives to ensure that access to healthy foods is available to all people in British Columbia.

Safety of the Food Supply

The food we eat must not only be nutritious and be consumed in the right proportions to maintain health; it must also be safe to eat. The potential public health impact of unsafe food is significant, capable of harming both individuals and large sectors of society. Food can be unsafe for consumption in many ways—through contamination with pathogens, toxins, or chemicals on the farm; during distribution, food processing, and retail operations through improper storage; or through unsafe food preparation in the home. Ensuring the safety of the food supply requires a "farm-to-fork" risk management approach that guards against risks or removes them at each point along the continuum that food travels from being grown, raised, or harvested, to the time it is consumed.

Most cases of foodborne illness are only recognized when at least two or more people become sick after eating a meal or food product in common. Symptoms can arise hours or even days after the food is consumed. The Canadian Food Inspection Agency reports that each year about 10,000 cases of foodborne illness are reported from which approximately 30 people die (Canadian Food Inspection Agency, 2005c). For every foodborne disease that is reported, many are not reported. The number of cases of foodborne disease was estimated to be over 650,000 in 2003, with an estimated cost of $988 per individual per year (Ministry of Health, 2005b).

According to the World Health Organization (WHO), a small number of factors related to food handling are responsible for a large proportion of foodborne diseases worldwide. The most common factors are:

- Cross-contamination of food.
- People with poor personal hygiene handling food.
- Preparation of food several hours prior to consumption, combined with improper storage at temperatures that favour the growth of pathogenic bacteria and/or the formation of toxins.
- Insufficient cooking or reheating of food to reduce or eliminate pathogens.

In terms of genetically modified foods, Canada's expert panel on the future of food biotechnology recommended that Canada apply the "precautionary principle" to the introduction of genetically modified foods; this principle states that new technologies should not be presumed safe unless there is a reliable scientific basis to consider them safe. As such, the panel called for more rigorous testing of genetically modified foods.

Food Security and Healthy Eating in the Aboriginal Population

Most indigenous populations worldwide, including the Canadian Aboriginal population, share a pattern of increased illness and mortality compared to non Aboriginal populations. The key considerations are a long history of colonization, cultural deprivation, political impotence, and systematic discrimination, as well as genetics, lifestyle, socio-economic factors, poor quality housing and community environments, unemployment, and low levels of education.

In British Columbia, the First Nation populations have higher incidence and prevalence rates of chronic diseases, such as Type 2 diabetes, compared to the rest of the BC population; these higher rates are directly linked to the issues of overweight and obesity. Traditionally, Aboriginal people had access to their own nutritious foods and were much more

Provincial Health Officer's Reports

Since 1993, the Provincial Health Officer has been required by the *Health Act* to report annually to British Columbians on their health status and on the need for policies and programs that will improve their health. Some of the reports produced to date have given a broad overview of health status while others have focused on particular topics such as air quality, drinking water quality, immunization, injection drugs, First Nations health, injury prevention, and school health. Reports by the Provincial Health Officer are one means for reporting on progress toward the provincial health goals, which were adopted by the province in 1997.

Copies of the Provincial Health Officer report are available free of charge from the Office of the Provincial Health Officer by calling (250) 952-1330 or at http://www.healthservices.gov.bc.ca/pho.

active. A combination of a change from the traditional diet to one high in starch and sugar, and a change to a sedentary lifestyle, coupled with a genetic propensity to store energy as fat (the "thrifty gene" hypothesis) may be responsible for the increase in obesity rates and high prevalence of chronic diseases among the Aboriginal population. The following changes are recommended to prevent obesity and related chronic diseases:

- Healthy and affordable foods should be available to Aboriginal communities (First Nations, Métis, and Inuit).
- The possibilities of local food production should be considered and supported.
- Government policies should support communities interested in a re-introduction of traditional diets or their equivalent.
- Neighbourhoods should be safe for families and children to be physically active.

The following recommendations from the 2001 Provincial Health Officer's Report, *The Health and Well-being of Aboriginal People in British Columbia*, are also important in this context:

- Improve housing conditions and economic and educational opportunities for Aboriginal people.
- Increase awareness of the health status of Aboriginal people and the challenges that Aboriginal people face.
- Pay more attention to the non-medical, cultural, and spiritual determinants of health.
- Encourage participatory research to gain a clearer understanding as to why some Aboriginal communities are "healthier" than others.
- Support efforts by Aboriginal people to achieve self-determination and a collective sense of control over their futures, in both on-and off-reserve communities.
- Encourage greater Aboriginal participation in the governance, design, and delivery of culturally appropriate health services.

Working Towards Change...

Health cannot be separated from environmental and societal influences surrounding the individual. Facing epidemics of obesity and chronic illness, governments need to strive to create environments that make the healthy choice the easy choice. We cannot expect people to make healthy choices when they live in unsupportive social and physical environments. It is therefore necessary to work towards creating a positive and healthy social, nutritional, and physical environment where people can have access to healthy and safe food, and can take part in physical activity that will allow them to live healthier lives.

Contents of this Report

The 2005 Provincial Health Officer's report intends to inform British Columbians of the role of food and nutrition in the lives of people in British Columbia. This report contains current research on nutrition and healthy eating, agriculture and food processing, the impact of unhealthy eating, food insecurity, the safety of the food supply and food and Aboriginal population in British Columbia. The last chapter focuses on recommendations for all the issues discussed in previous chapters.

Chapter 1: Nutrition and Health

Why Do Food and Diet Matter?

The saying, "You are what you eat," is true. The food we put in our mouths defines to a great extent our health, growth, and development, and ability to function well in a complex world. Eating a variety of nutrient-rich, high quality foods with the right proportions of fat, protein, carbohydrates, fibre, vitamins, minerals, and other dietary constituents, provides our body with what it needs for optimal growth and development.

A healthy diet provides the ingredients we need to build and repair our bones and tissues and keep the complex workings of the human body functioning optimally. It gives us the mental and physical energy necessary for daily life—work, recreation, relationships, and family life.

A healthy diet also protects us from infectious illnesses and chronic diseases so that we may age with a minimum of ill health, pain, disability, and lost work days. Poor or unbalanced diets are either the primary risk factor, or a major contributing factor, to a host of chronic diseases such as heart disease, stroke, cancer, diabetes, and high blood pressure (World Health Organization [WHO], 2003b). The health problems that arise from unhealthy diets will be discussed in Chapter 3 of this report.

What is a Healthy Diet?

In our culturally diverse world, many traditional ways of eating have the right components to be considered "healthy", i.e., providing the nutrients required to support and promote health.

In British Columbia, for the most part, the majority of the population has ready access to a wide variety of healthy food choices to support healthy eating patterns. We have an abundance of local and imported fruits and vegetables; increasing diversity in cereal and whole grain products; a variety of milk, yogurt, and cheese choices; and a wide range of lean meats, poultry, seafood, eggs, nuts, seeds, and legumes.

In addition, our increasing cultural diversity is exposing us to a rich and enticing variety of food choices and styles of cuisine. While 50 years ago it would have been rare for the majority of British Columbians to stray from a basic meat-and-potatoes diet, now both in our restaurant choices and home cooking we can and do eat from an international array of styles: Greek, Italian, Japanese, Chinese, Vietnamese, Thai, Indian, Mexican, and more. In short, many different dietary patterns can satisfy both hunger, nutrient, and lifestyle needs and therefore confer lasting health benefits. The majority of British Columbians are fortunate to have this smorgasbord of options.

Nutritional Confusion and Temptation

This abundance of choice, however, makes the public health message about how to eat healthy much more complex. Unlike simple public health messages, such as "don't smoke" to reduce the impact of tobacco-related illness, informing people on what to eat to improve health and reduce disease is more challenging.

What Do Healthy Diets Have in Common?

Many healthy diets share similar features. Recent research has affirmed the traditional Mediterranean diet as one of the ideal styles of eating to promote longevity and a range of health benefits, particularly the prevention of heart disease and a decreased risk of a variety of cancers (Hu, 2003; Trichopoulou, Costacou, Bamia, & Trichopoulos, 2003; Singh et al., 2002).

The traditional Mediterranean diet features:

- An abundance of unprocessed plant food (fruit, vegetables, whole grains, nuts, seeds, and legumes).
- Olive oil as the principal fat.
- Fish and poultry weekly.
- Red meat once or twice a month.
- Wine with meals but not to excess.

This diet—high in fibre, low in saturated (animal) fat and trans fats—is very similar to the Dietary Approaches to Stop Hypertension (DASH) diet, and to the recommendations of *Canada's Food Guide to Healthy Eating*. With a minimum of processed foods and an abundance of grains, vegetables, fruits, nuts, and seeds, these diets provide a healthy, well-balanced way of eating and are also satisfying to most palates.

Many people, regardless of education level, become confused when faced with the modern array of food choices now available and are not sure how to choose the best diet for themselves and their families. Complicating the picture are individual factors such as taste preference and cultural patterns. On a larger scale, food supply issues such as seasonal and geographical availability, agriculture and food manufacturing infrastructure, and cost, all impact choice.

Adding to the challenge of choosing healthy food is the increasing availability of relatively cheap, often tasty, and usually satisfying high-calorie, low-nutrient foods, such as fast food, snack foods, pop, candy, and other highly refined and processed foods. These foods typically contain calories in the form of fat or sugars and are often high in salt and low in nutrients such as the vitamins and minerals needed for optimal body function. These nutritionally poor foods compete with and often displace healthy food choices in many people's diets, creating a paradox of being overfed but undernourished. Obesity and nutrient deficiencies can result in serious health consequences. The 1999 BC Nutrition Survey (Ministry of Health Planning [MOHP], 2003) identified that 25 per cent of food in British Columbians' diets came from the types of foods found in the "other" food group from *Canada's Food Guide to Healthy Eating*. The intake of several vitamins and minerals was also inadequate despite the use of supplements by the majority.

Other factors also contribute to the challenges of healthy eating. Eating styles have changed over the last three decades and the modern family is more likely to eat meals away from home in restaurants, or to pick up prepared and prepackaged convenience foods. In 1970, American families spent one-third of their food dollars on meals outside the home. This has grown steadily so that by 2001, the average family spent 47 per cent of food dollars away from home (Sturm, 2005b). Prepackaged meals, and foods prepared in restaurants and fast-food outlets, tend to have more calories, fats, sugars, and salt (relative to nutrient content) than food prepared at home.

Portion sizes in restaurants and fast-food outlets have also greatly increased over the last two decades, inducing people to consume more calories at a single sitting than they need. This "portion distortion" and other factors contributing to excess calorie consumption are discussed in more detail in Chapter 3.

A recent study found that too much choice itself can promote weight gain; both humans and animals alike tend to overeat when surrounded by many tempting tastes but reach satiation faster when eating just one food (Raynor & Epstein, 2001).

Consumers can also be confused by promotions and labels that seem to advertise a food as being healthier than it actually appears. Labels such as "cholesterol-free" on a bag of potato chips that are high in fat and salt, or "low-fat" on cookies and baked goods that are high in sugar play into the widespread consumer confusion around nutrition. In 2003, to combat the confusion in labelling, Health Canada brought in new regulations making nutrition labels mandatory on most prepackaged food; however, the aggressive marketing of food can still confuse some consumers.

Role of Food Guides

Many countries, including Canada, have adopted official food guides to help provide dietary guidance. The guides promote a pattern of eating for their citizens that reflects widely available food choices, nutrient needs, and good health, and aim to reduce the risk of nutrition-related health problems and chronic disease.

The guides are based on a national consensus of scientists; they identify the nutritional requirements, and provide pictorial representations of the types of foods, in their varying proportions, that are needed daily to promote health. The graphic depiction varies from country to country. Some countries have food pyramids, others food wheels or pie charts, and some use food dinner plates. Canada uses a colourful food rainbow showing the relative proportions of meat and alternatives, milk products, vegetables and fruits, and grain products that Canadians should eat to achieve optimal health.

While there are some differences between countries in their food guides, the recommendations remain very similar (Painter, Rah, & Lee, 2002). The core recommendations for most countries are:

- Consume generous amounts of whole grains, vegetables, and fruits; and
- Consume moderate amounts of meat, milk, and dairy products.

Although food guides are carefully designed, they have their limitations. Food guides need to convey complex, scientific information on nutrition in a simple, straightforward, easy-to-understand manner. In addition, they need to reflect a country's food supply and the patterns of eating followed by the majority. Food guides in the past have come under criticism, particularly from some nutritional advocates who charge that the recommendations in most countries are not forward thinking, and are sometimes subject to intense lobbying from powerful sectors of the food industry, which then influences the message and the pictures of the food displayed (Nestle, 2002; Lang & Heasman, 2004).

Canada's Food Guide To Healthy Eating

When Canada's first food rules were released in 1942, in the midst of the Second World War, the primary aim was to prevent malnutrition during a time of food rationing. The federal government's dietary recommendations have had six revisions over the last six decades to keep them abreast of changing times. The most recent revision occurred in 1992, and another revision is currently underway.

The 1992 revision changed the title, introduced the rainbow graphic, and shifted philosophy from identifying minimum daily requirements to prevent deficiencies, to a total diet approach to prevent chronic diseases, by setting daily ranges based on the varying energy needs of different individuals (Health Canada, 2002).

The 1992 guide provides both serving size guidance and recommendations to make healthier choices in each food group:

- **Grain Products:** five to twelve servings per day, choosing whole grain breads and cereals more often over processed white flour products, pastas, or rice.

Mandatory Nutrition Labels

In 2003, Health Canada brought in regulations requiring most food labels to carry a standardized nutrition facts table. The regulations took effect in December 2005 for large manufacturers (smaller manufacturers have until December 2007), although some companies began displaying the tables well before that date.

The facts table lists nutritional information such as the amount of calories, sugar, saturated fat, trans fats, protein, sodium, and other vitamins and minerals, and the percentage of daily requirements in the food. This standardized information can help consumers make more informed, healthy choices, regardless of promotional claims on the front of the package.

What is a Serving?

Canada's Food Guide to Healthy Eating uses the term "servings" to describe how much of a food to eat. The following are examples of one serving:

- 1 slice of whole grain bread, or 1/2 of a bagel or bun (30 g);
- 1 cup of salad;
- 1 medium banana, apple, or carrot, or 1/2 cup of juice;
- 1 cup of milk;
- 3/4 cup yogurt;
- a meat portion the size of a deck of cards;
- 1/2 can of fish;
- 3 tbsp peanut butter;
- 1/2 cup lentils/legumes.

There is evidence that people find the terminology "serving" confusing and this is being examined in the new round of revisions of the Food Guide (Health Canada, 2003c).

- **Vegetables and Fruit:** five to ten servings a day, choosing dark green and orange vegetables and orange fruit more often.
- **Milk Products:** Number of servings vary with age:
  - **Children 4-9:** two to three servings daily.
  - **Youth 10-16:** three to four servings daily.
  - **Adults:** two to four servings daily.
  - **Pregnant or breastfeeding women:** three to four servings daily. Choices include 2% or lower fat milk, evaporated milk, powdered milk, various cheeses (including low fat or skim milk varieties), and lower fat yogurt.
- **Meat and Alternatives:** two to three servings per day. Choices include various cuts of beef, pork, lamb, or poultry; fresh or canned fish; eggs; beans and lentils; tofu; and nuts, with the recommendation to choose leaner meats, poultry, fish, and dried beans and lentils more often.

The guide notes that the amount of food an individual requires each day from the four food groups depends on the person's age, body size, activity level, and sex. Young children and the elderly tend to need the lower number of servings while male teenagers or pregnant and lactating women need a higher number. Most people would require serving numbers in the mid-range.

In addition, the guide makes some other general recommendations about healthy eating:

- Enjoy a variety of foods each day.
- Emphasize cereals, breads, other grain products, and vegetables and fruit.
- Choose lower-fat dairy products, leaner meats, and food prepared with little or no fat.
- Achieve and maintain a healthy body weight by enjoying regular physical activity and healthy eating.
- Limit salt, alcohol, and caffeine.

According to Health Canada, the Food Guide is the most popular site on its website (Health Canada, 2002). The Food Guide's influence in institutional or public settings is widespread. Schools, hospitals, retirement homes, and other institutions usually set their menus based on *Canada's Food Guide to Healthy Eating*.

The BC Nutrition Survey

The 1999 BC Nutrition Survey was designed to obtain information on the eating habits of the adult population in British Columbia. The survey involved a total of 1,823 people aged 18 to 84 throughout British Columbia who were interviewed in their homes by specially trained public health nurses and nutritionists.

The 1999 BC Nutrition Survey has created the first provincial database of food consumption and nutrient intake information, and can serve to monitor future comparisons and trends in nutritional and dietary choices (MOHP, 2003).

The survey results showed that the majority of men and women in BC (as high as 84 per cent in some age groups) ate less than the recommended amount of fruits, vegetables, and milk products. In summary:

- 25 per cent of all calories consumed came from high-calorie, low-nutrient food; primarily from foods and beverages such as chips, pop, candy, jams, alcohol, etc.
- 65 per cent of all participants were not consuming the suggested five servings of vegetables and fruits each day.
- 77 per cent of participants were not consuming the suggested two servings of milk products.
- Many were not getting the necessary vitamins and minerals from their diets. The groups with the greatest nutrient concerns were women and seniors. The vast majority of participants were not consuming enough fibre.
- 25 per cent of participants were consuming more than 35 per cent of their caloric intake from fat.
- 55 per cent of participants were overweight or obese, based on actual measurements of body mass index (BMI) and waist circumference. This rate is higher than self-reported measurements and gives evidence that BC's obesity problem may be worse than previously reported. The issues around increasing rates of obesity are discussed in Chapter 3.

Understanding the Determinants of Healthy Eating

Why do some British Columbians eat relatively healthy and others do not? As part of the research activities around the revision of *Canada's Food Guide to Healthy Eating*, Health Canada commissioned a small study examining consumers' perspectives on healthy eating (Health Canada, 2005c). The participants in general showed good knowledge of what constitutes healthy eating, by naming whole grains, fruits and vegetables, fish and lean protein, and low-fat milk products as the healthier choices. However, the researchers noted a number of factors that could interfere with healthy eating:

- **Time:** Participants felt there was a lack of time in busy working lives to plan meals, shop for ingredients, and prepare menus from scratch; as a result they often chose to purchase and eat pre-made convenience foods.
- **Effort:** The effort and energy it takes to eat healthy was identified as a barrier. As well, good meal planning is required for timely use of fruits and vegetables and other fresh ingredients like fish and meat before they spoil.
- **Knowledge and skills:** Participants cited a lack of ideas for creating a variety of healthy meals as a barrier. Others were confused about contradictory food messages, particularly around proteins and carbohydrates.
- **Taste:** Some participants stated that even though they knew some foods were healthier, they did not like the taste, particularly of vegetables, and instead had cravings for prepackaged and prepared foods.
- **Cost:** The cost of fruits, vegetables, and other less processed food was a barrier to healthy eating. This issue, along with others around food availability and food insecurity, is discussed in Chapter 4.

▶ Revision of Canada's *Food Guide to Healthy Eating*

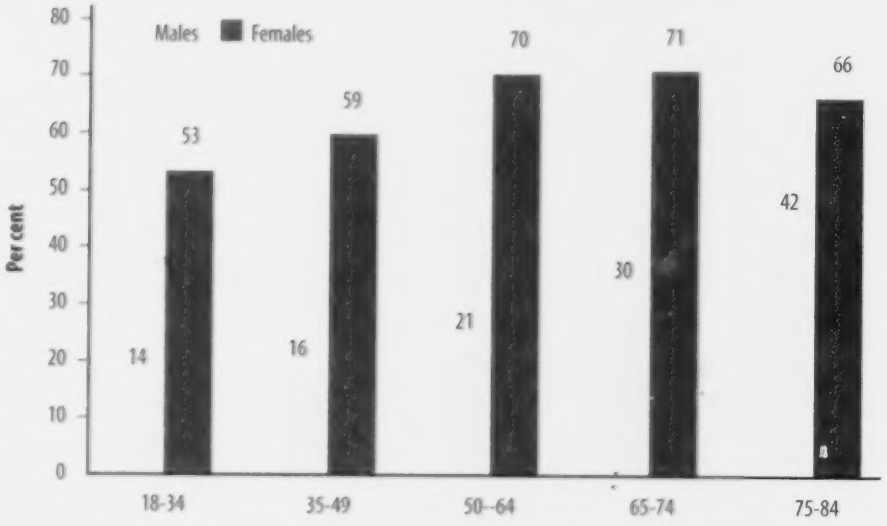
In 2002, Health Canada announced that *Canada's Food Guide to Healthy Eating* would be revised to take into account the changing nature of Canadian society. The guide does not need a wholesale change. Rather it needs to be updated to include the changing nature of our food supply, the increasing ethnic influences on food choices, the growing problem of obesity, and the advances in scientific knowledge over the last decade.

The revision process, which is still underway, has involved broad consultations including focus groups with consumers, and input from the food industry, health organizations, governments, universities, consumer groups, and other agencies. Working groups and advisory committees were established in 2004 and have commissioned further research. Stakeholder consultations and consumer test groups are expected to continue, with the final revision of the Food Guide released sometime in 2006 or 2007.

Figure 1.1

Percentage of BC Adult Population not Meeting the Suggested Five Servings of Grain Products Recommended by Canada's Food Guide to Healthy Eating, BC, 2003*

- Based on the 1999 BC Nutrition Survey, overall, 41 per cent of all participants did not meet the recommended servings of five grain products per day.
- Females were 3 times less likely to meet the recommended servings of five grain products than males.
- Over 65 per cent of females 50 years of age and older did not meet the minimum recommended servings of five grain products.

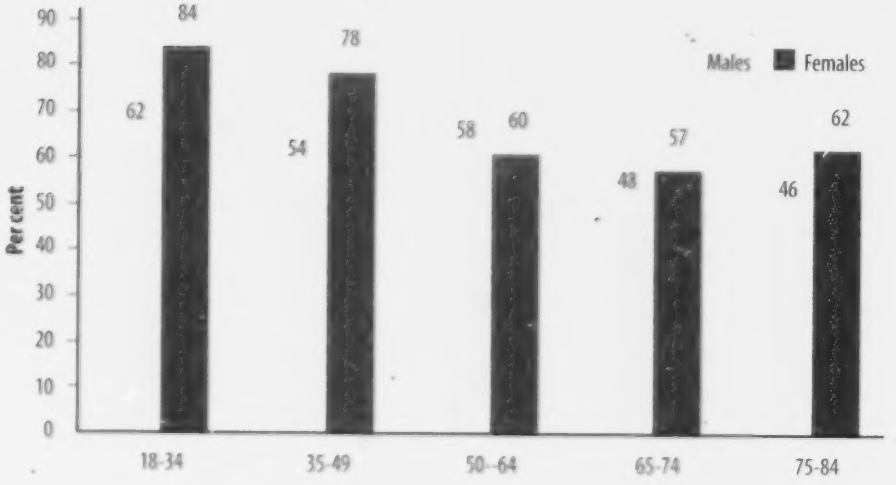


* The data adjusted for intra-individual variability and weighted by sample weights to provide population estimates.
Source: Jenkins B. & Laffey, P., BC Nutrition Survey, Canada Food Guide Tables, E451313-011 CFG-V1, 2003. Health Canada

Figure 1.2

Percentage of BC Adult Population not Meeting the Suggested Five Servings of Vegetables and Fruits Recommended by Canada's Food Guide to Healthy Eating, BC, 2003*

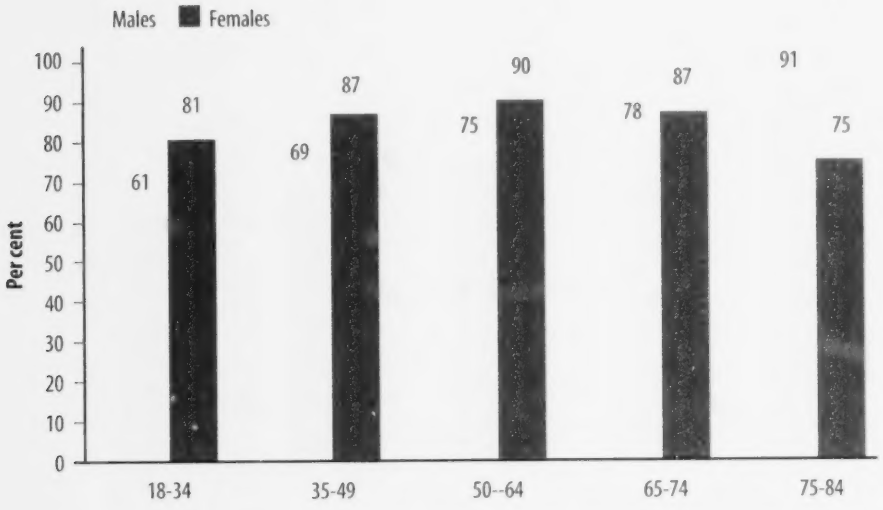
- Overall, 73 per cent of females and 56 per cent of males did not meet the recommended servings of five vegetables and fruits.
- Approximately 62 per cent of males and 84 per cent of females between 18 and 34 years of age did not meet the recommended five servings of vegetables and fruits.
- As with grain products, females were much less likely than males to meet the recommended servings of five vegetables and fruits.



* The data adjusted for intra-individual variability and weighted by sample weights to provide population estimates.
Source: Jenkins B. & Laffey, P., BC Nutrition Survey, Canada Food Guide Tables, E451313-011 CFG-V1, 2003. Health Canada

Percentage of BC Adult Population not Meeting the Suggested Two Servings of Milk and Milk Products Recommended by Canada's Food Guide to Healthy Eating, BC, 2003*

Figure 1.3



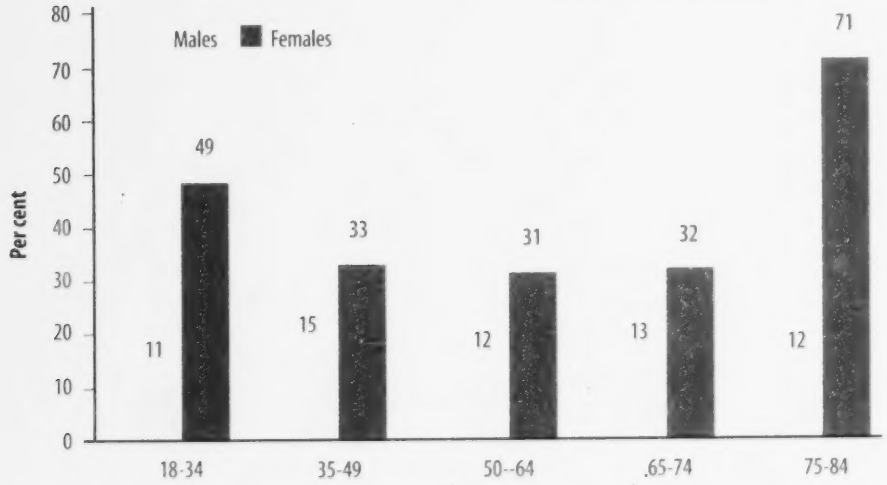
- Overall, approximately 77 per cent of those surveyed did not meet the recommended minimum two servings of milk and milk products.
- Over 80 per cent of females in every age group (except those 75-84) did not meet the recommended minimum two servings of milk and milk products.

* The data adjusted for intra-individual variability and weighted by sample weights to provide population estimates.

Source: Jenkins B. & Laffey, P., BC Nutrition Survey, Canada Food Guide Tables, E451313-011 CFG-V1, 2003. Health Canada

Percentage of BC Adult Population not Meeting the Suggested Two Servings of Meat and Meat Products Recommended by Canada's Food Guide to Healthy Eating, BC, 2003*

Figure 1.4



- Overall, approximately 26 per cent of those surveyed did not meet the minimum recommended two servings of meat and meat products.
- Over 70 per cent of females 75 years of age and over did not consume the minimum recommended two servings of meat and meat products.
- Males were much more likely to meet their minimum recommendations of two servings of meat and meat products than females.

* The data adjusted for intra-individual variability and weighted by sample weights to provide population estimates.

Source: Jenkins B. & Laffey, P., BC Nutrition Survey, Canada Food Guide Tables, E451313-011 CFG-V1, 2003. Health Canada

Getting 5 to 10 a Day

Eating at least 5 to 10 servings of vegetables and fruits a day may be the single most important food change most British Columbians can make to improve their health. Some simple ways to do this are:

- Slicing fresh fruit on breakfast cereal.
- Making a yogurt smoothie with three or four fruits.
- Drinking a low-sodium vegetable drink.
- Adding spinach to soups and salads.
- Ordering vegetarian pizza with extra veggies.
- Washing and preparing celery sticks, carrots, peppers, and other vegetables and storing them in the refrigerator for easy snacking.
- Freezing 100 per cent juice as popsicles for a frozen treat.
- Having frozen vegetables on hand and adding them to soups, omelettes, and stir-fries.

Healthy Components: The Change in Understanding Fats, Proteins, and Carbohydrates

Over the last ten years the science of nutrition has been expanding, in particular our understanding of the health-related roles of fats, proteins, and carbohydrates. The science behind nutrition research is often very complex and full of controversy. The new Dietary Reference Intakes recommend the following standards to best prevent chronic diseases, and ensure adequate intake of essential nutrients:

Fat: 20 to 35 % of calories

Carbohydrates: 45 to 65 % of calories

Protein: 10 to 35 % of calories

Infants and young children have a greater need for fat (particularly in the first 2 years of life) so their fat intake should be slightly higher at 50 per cent of calories for infants (standard set by breast milk) and 25 to 40 per cent of calories for young children (Institute of Medicine [IOM], 2005).

Fats

Why are fats so important? Most people think that fat only clogs our arteries or contributes to obesity. But fats have an essential role to play in nutrition as they help with absorption of fat-soluble vitamins A, D, E, and K, as well as other nutrients, and provide flavour and satiety at our meals. Fats become part of the membrane of every cell in our body, which dictates how well the cell functions by enabling the passage of essential compounds, like insulin, and preventing the transmission of harmful influences, such as potential carcinogens. Fat is also the main component in our brain, and plays a crucial role in protecting our nerve fibres throughout our entire body. Having enough of the right fat in the diet is particularly important to the growth and development of young children, particularly brain development. A low-fat diet can be very harmful to young children.

The recommendations for fat intake have changed over the years. In the 1960s, it was thought that diets high in fat were associated with higher rates of cardiovascular disease, heart attack, and stroke. The advice for two decades was to eat a low-fat, low-cholesterol diet, choosing lean animal food products as much as possible.

In the 1980s, the advice was to reduce saturated fat (predominantly from animal sources) and increase polyunsaturated fat (predominantly from plants.) In the 1990s, a growing awareness of essential fatty acids called omega-3 led to more emphasis on consuming healthy sources of fat such as fish, walnuts, and flax.

Omega-3 and omega-6 fatty acids are not produced in our bodies and therefore must be consumed on a regular basis. Omega-3 fatty acids are best consumed from food choices and not from supplements (Covington, 2004). Generally, North Americans eat enough omega-6 in their diet, particularly through meat and eggs. Research shows that these fats support better pregnancy and breastfeeding outcomes, may reduce the risk of cardiovascular disease or sudden death from heart arrhythmias, and may also reduce inflammation and blood clotting factors (Covington, 2004).

The healthier fats are beneficial because they seem to increase the levels of high-density lipoproteins (HDL) in the blood, which are responsible for carrying cholesterol to the liver where it is

eliminated. These are often called "good cholesterol". The low-density lipoprotein (LDL) is responsible for the buildup of cholesterol on the walls of blood vessels, and is often known as "bad cholesterol".

There is new research showing that many saturated fats, traditionally seen as less healthy, may actually be neutral or even beneficial to health. Milk fat, cocoa butter, and even some fats found in red meats have shown a positive impact on weight and heart disease risk (Hu, Manson, & Willett, 2001). Clarifying the role of fats in healthy diets will be the source of much research in the next decades.

Healthy Fats

- Plant oils, such as olive oil, canola oil
- Fish oils from fatty fish such as tuna and salmon
- Flaxseed and walnuts

Less Healthy Fats

- Animal fats, such as butter, high-fat cheeses, beef tallow, and high-fat red meat

Fats to avoid

- Trans fats found in processed foods such as cookies, crackers, and snack food

However, it should be noted that all fats are high in calories; therefore, even when consuming healthier fats, if more calories are consumed than are burned off, weight gain will result, leading to potential health risks.

Carbohydrates

Carbohydrates are a group of compounds derived from plants, which include simple and complex sugars, starches, and fibre. Carbohydrates either break down into glucose (also called blood sugar), or pass through mainly undigested as fibre. Glucose is the fuel that the cells burn to function. Insulin, released by the pancreas, is the vehicle that carries glucose to the cells and allows it to be transported across the cell membrane. Fibre is essential in our diets, too, for its role in preventing constipation and helping promote healthy digestive function.

Carbohydrates have been primarily classified as simple or complex carbohydrates depending on the length of the molecular chain. Simple carbohydrates are short chain sugars such as fruit sugar (fructose), corn sugar (dextrose), and table sugar (sucrose). Complex carbohydrates are the longer chain sugars most often found in vegetables, grains, and starches. Now a new classification system, called glycemic index, is emerging based not on chain length but instead on how fast carbohydrates are broken down into glucose in the digestive process.

The widespread dietary advice in the 1980s and 1990s was to reduce the consumption of simple carbohydrates and increase the consumption of complex carbohydrates. Between 1991 and 2001, the consumption of all carbohydrates, both simple and complex, increased by 15 per cent (Statistics Canada, 2002). The increase in carbohydrate consumption in the form of sugar consumption and its relation to ill-health and obesity is discussed in greater detail in Chapter 3.

Despite the complex science surrounding carbohydrates, there is fairly simple advice that has remained remarkably consistent over the years: *Eat plenty of whole grains, fruits, and vegetables, and reduce processed food.*

Dietary Reference Intakes

The Dietary Reference Intakes (DRIs) are a comprehensive set of nutrient reference values for healthy populations that can be used for assessing and planning diets. The DRIs replace previously published Recommended Nutrient Intakes. These were established by Canadian and American scientists through a review process overseen by the United States National Academies, an independent, non-governmental body (IOM, 2005).

The DRIs reflect the current state of scientific knowledge with respect to nutrient requirements. The Health Canada's Office of Nutrition Policy and Promotion will be using the DRIs to ensure that dietary guidance to Canadians, such as *Canada's Food Guide to Healthy Eating*, is scientifically sound. The DRIs will also be used to assess the nutrient intakes of Canadians. The functional indicators used to establish the DRIs will be considered when interpreting the dietary assessment.

The DRIs are published as a series of reports by the National Academy Press. The reports can be viewed online and ordered from the National Academy Press at: http://search.nap.edu/nap-cgi/naptitle.cgi?Search=dietary+reference+intakes.

Trans Fats

Trans fats are artificially created by heating liquid vegetable oils with hydrogen. They usually appear as "hydrogenated vegetable oils" on food labels. Over the last 30 years, this man-made fat has become ubiquitous in processed food such as cookies, crackers, potato chips, french fries, and other snack foods such as microwave popcorn and frozen pizza. Some trans fats naturally occur in the meat or milk of ruminant animals, such as beef and lamb, and research is starting to show that these natural trans fats do not have the same harmful properties as commercially produced trans fats.

Since trans fats have been linked to heart disease, Canadian consumption of them is now recognized as a significant public health issue. Research over the last decade has found that commercially produced trans fats increase LDL and decrease HDL cholesterol (Hu, Manson, & Willett, 2001). It is becoming increasingly clear that Canadians should drastically reduce, or eliminate, all trans fats. In November 2004, the federal government created a multi-stakeholder task force to develop recommendations and strategies to reduce trans fats in Canadian foods to the lowest levels possible. The total trans fat content for all vegetable oils and soft, spreadable margarines sold to consumers or used as an ingredient in the preparation of foods on site by retailers or food service establishments should be limited to 2 per cent of total fat. The total trans fat content of all other foods should be limited to 5 per cent of total fat content (Health Canada, 2006). Due to new nutrition labelling and public awareness, manufacturers have started to eliminate unnecessary trans fats from their products.

Proteins

Protein is important for the building, maintaining, and repair of body tissues. It is the building block of our structural elements such as bones, muscles, and cells, and is important in the body's natural defense system against disease. Over the last decade, an increasing scientific focus has been on the role proteins and their relative proportions play in healthy eating. This scientific interest has been fuelled by the popularity of high-protein, low-carbohydrate diets, specifically the Atkins Diet. One major concern is that a high-protein, low-carbohydrate diet deliberately puts people into a metabolic state called ketosis. In ketosis, fat is burned, creating harmful residues called ketones that can accumulate in the body, potentially damaging the kidneys and other organs (Duggirala & Mundell, 2003). A second concern is the limited amount of vegetables, fruits, and whole grains on the diets, and the long-term impact this may have on the risk of chronic disease and cancers.

Over the last four years, a number of randomized controlled trials have shown that while initial weight loss is generally more rapid on the high-protein diets, after a year, there was no difference between the amount of weight lost or blood lipid levels compared to a low-fat, high-carbohydrate diet (Samaha, et al., 2003; Foster, Wyatt, & Hill, 2003; Stern et al., 2004). Limitations of studies were high dropout rates (greater than 34 per cent for both diets) and low compliance to both diets by study participants (Ware, 2003). In more recent studies, similar results were found, and it was concluded that it is not the individual components of the diets, but overall caloric restriction leading to weight loss that was probably the major factor leading to some positive results (Yancy, Olsen, Guyton, Bakst, & Westman, 2004; Dansinger, Gleason, Griffith, Selker, & Schaefer, 2005).

One salient fact has been illuminated by the popularity of high-protein, low-carbohydrate eating: protein and fat tend to be more satiating than carbohydrates (Yancy et al., 2004). Therefore, eating a balanced diet that includes some healthy fat and lean protein at each meal combined with fruits, vegetables, and whole grains will be more satiating and sustaining, and can reduce the need to snack between meals.

Micronutrients: Vitamins, Minerals, and Phytochemicals

The intake of a wide range of micronutrients, including vitamins, minerals, and phytochemicals (or antioxidants) is essential to healthy growth and development. Deficiencies in various vitamins and minerals can lead to significant health problems, such as scurvy (vitamin C), rickets (vitamin D), blindness (vitamin A), anemia (iron), weak bones (calcium), or spina bifida (insufficient folic acid in pregnancy).

In recent years, research has shown that phytochemicals may also be equally essential to good health. Found in plants, these compounds include beta-carotene (found in carrots and other orange fruits and dark green vegetables), lycopene (found primarily in tomatoes), and flavonoids (found primarily in soy products). By eating a wide array of colourful fruits and vegetables—orange, yellow, red, green, blue, and purple—people will be exposed to the unique array of phytochemicals, as well as essential vitamins, minerals, and fibre that each colour has to offer alone and

in combination. There is evidence that phytochemicals, particularly beta-carotene, lycopene, and minerals and vitamins such as vitamin E, may be more effective when consumed in foods than taken as a supplement (Willett & Stampfer, 2001). These phytochemicals may be one reason why the consumption of fruits and vegetables is so beneficial to health and seems to ward off cancer and other diseases. See Chapter 3 for more discussion about dietary links to specific diseases.

For decades, the nutritional advice for the general population has been that if you are eating from the four food groups according to *Canada's Food Guide to Healthy Eating* you do not need extra vitamins or minerals in the form of supplements to get enough of these beneficial micronutrients. The results of the 1999 BC Nutrition Survey found that the majority of diets in BC are low in the recommended dietary intakes of many essential micronutrients:

- Many adults have inadequate dietary intakes of folate, vitamins B6, B12, and C, magnesium, and zinc.
- Intake of calcium and fibre was below recommended levels for all adults.
- 10 to 14 per cent of pre-menopausal women had inadequate iron intake.
- Almost half of BC seniors who completed the survey reported that they did not obtain enough folate and 16 per cent had low levels of vitamin B6.
- Between 10 to 21 per cent of BC seniors did not receive enough vitamin B12.

Perhaps because many people believe they are not getting adequate nutrition in their daily food choices, supplement use in BC is common. In a separate analysis of the BC Nutrition Survey data (Barr; 2004) it was found that:

- 46 per cent of the population had taken one or more supplements on the previous day and 64 per cent in the previous month.
- Of those who took supplements, the majority were taking only one or two supplements, but almost 25 per cent had taken four or more supplements on the previous day.
- Supplement use was more common in women than men and in adults over the age of 50 compared to younger adults.
- Daily multivitamins were the most common supplements consumed but many people reported taking non-vitamin supplements such as glucosamine and/or chondroitin sulphate, garlic, various oils, echinacea, and gingko biloba.
- Supplement use was contributing to the nutritional inadequacy of the diets but in some cases (such as seniors) more supplements such as vitamin B12 might be needed for seniors.

The BC Nutrition Survey authors concluded that due to the degree of supplement use, recommendations for supplement use in future dietary guidance, such as *Canada's Food Guide to Healthy Eating*, should be included. Education regarding effective use of supplements and potential adverse effects from excessive supplements should also be addressed.

We know that the same health benefits of eating a variety of healthy foods varied in colour and nutrients cannot be achieved by taking a vitamin or mineral supplement.

The "Low-Carbohydrate, High-Protein" Diet

The low-carbohydrate, high-protein diet was promoted as early as the 1960s as a way to rapidly lose weight and improve cardiovascular disease (Atkins, 1998). The diet gained popularity in the 1980s, but after some related deaths it dropped out of favour until it was reinvented and promoted as the New Atkins Diet.

The Atkins Diet, which heavily restricts carbohydrates and promotes the consumption of unlimited protein and fat, has been highly controversial among health professionals, some of whom charge that the diets are dangerously high in saturated fat, compromise vitamin and mineral intake, and risk causing cardiac, renal, and liver abnormalities if people follow them for longer than a few months (St. Jeor et al., 2001). One of the most controversial recommendations of the Atkins diet states that during the induction phase of the diet, one can eat all the bacon, eggs, steak, and other high-fat, high-protein foods one wants, but must not eat fruits, grains, or vegetables.

Despite the more than 30 years of public popularity—and the lasting, vociferous scientific opposition against it—there is little scientific evidence about the health impacts, whether positive or negative (Ware, 2003).

Glycemic Index (GI)

The glycemic index was conceived in the early 1980s by Dr. David Jenkins from the University of Toronto. The index measures how fast a carbohydrate is converted to glucose through the digestive process. Some carbohydrates break down into glucose very quickly and are said to have high glycemic indexes. Others break down more slowly, produce more gentle increases, and require less insulin to transport the glucose into cells. The overall glycemic response (or glycemic load) is how much sugar is released into the bloodstream at once. It can be influenced by how much carbohydrate is in the food, how much you eat, what foods are paired together, and how the food is cooked. The following are the glycemic index levels of some common foods:

Low glycemic index:

- skim milk, plain yogurt, apple, orange, plums, pinto beans, lentils, chickpeas, peanuts, peaches, pumpernickel bread, all-bran cereal.

Medium glycemic index:

- banana, pineapple, new potatoes, popcorn, brown rice, whole wheat bread, shredded wheat cereal.

High Glycemic Index:

- white rice, baked white potatoes, cornflakes, rice crispies, white bagel, most crackers, french fries, table sugar.

For more information, please contact the Canadian Diabetes Association at: http:// www.diabetes.ca/Section_About/glycemic.asp .

For most British Columbians, taking a daily multivitamin/multimineral compound is safe and probably helpful to their overall health, particularly if diets remain poor. Others such as pregnant women and seniors, as described later in this chapter, need extra micronutrients. The best advice is still to get the majority of your vitamin and mineral needs from a well-balanced diet; however, it should be noted that supplements do decrease the level of nutritional inadequacies in the population.

Food Fortification to Improve Health

Adding vitamins and minerals to common food staples is a proven public health technique to correct identified nutritional deficiencies at a population level and promote better health. Food fortification has a long history in Canada and is generally a public health success story.

Canada began its food fortification history with the voluntary addition of iodine in salt in 1949 (the United States had done this in 1924). This addition was responsible for virtually eliminating goiter, a common thyroid disorder (National Academy of Sciences [NAS], 2003). In 1944, following studies that found a high percentage of the population were suffering from nutritional deficiencies, Newfoundland introduced the mandatory fortification of flour with calcium, iron, and B vitamins, and fortification of margarine with vitamin A. Soon after, this practice was adopted across Canada.

To try and reduce the high incidence of rickets, vitamin D was added to milk products beginning in the 1950s—first dried, then evaporated, and then fluid milk. The incidence of rickets began to fall by the early 1970s and soon after was virtually eliminated (NAS, 2003).

Canada, the United States, Chile, and Australia began adding folic acid to flour in the late 1990s (Honein, Paulozzi, Mathews, Erickson, & Wong, 2001). Within a few years, neural tube defects such as spina bifida in newborns had dramatically decreased, by at least 20 per cent and up to 54 per cent in some locales (Gucciardi, Pietrusiak, Reynolds, & Rouleau, 2002; Persad, Van den Hof, Dubé, & Zimmer, 2002). As was noted in the 2002 Provincial Health Officer's *Annual Report on the Health and Well-being of People in British Columbia*, folic acid fortification also appears to be good for adult health, as it has been linked to a decrease in vascular disease (blood clots and hardening of the arteries) as well as a decrease in cancer, particularly colorectal cancer (Bailey, Rampersaud, & Kauwell, 2003).

The benefits of folic acid fortification have led some public health experts to advocate for an increase in folate levels (Oakley, 2002). However, authors of a recent Canadian study note that more population-based studies are needed to further assess the effects of fortification of flour, to determine whether fortification levels should be increased, and to rule out whether or not it would mask pernicious anemia (vitamin B12 deficiency) in older adults (Persad, 2002).

In 1998, Canada began allowing manufacturers of soy and other vegetable "milk" products to voluntarily fortify the drinks with between 6 and 15 micronutrients. This voluntary fortification offers more options for consumers to gain nutritional benefits from milk alternatives.

Dietary Needs at Specific Life Stages

At certain times in our life we have greater or lesser needs for calories and nutrients: during pregnancy and lactation, infancy, and advancing age, for example. This can alter the concept of what is considered a healthy diet for any specific life stage. The dietary needs of children and adolescents, particularly the relationship between diet and the growing concern over obesity rates, are discussed in more detail in Chapter 3.

Pregnancy and Breastfeeding

An increase in both calories and nutrients are needed to meet the physiological demands of both mother and child to support a healthy pregnancy and breastfeeding. The mother's nutrition affects how the baby grows in uterus, as well as during breastfeeding. There is some indication that appropriate fetal and infant nutrition and growth is essential for helping to prevent chronic diseases later in life—many researchers use the phrase "fetal origins of adult disease."

Canada's Food Guide to Healthy Eating forms the basis of a healthy diet for women during pregnancy and breastfeeding; the guide recommends that this group consume additional servings from the grain, vegetable/fruit, and milk products food groups. Typically, pregnant and breastfeeding women need to eat three regular meals a day and at least three snacks to meet their nutritional needs. Women should pay particular attention to the following key nutrients that support healthy moms and babies.

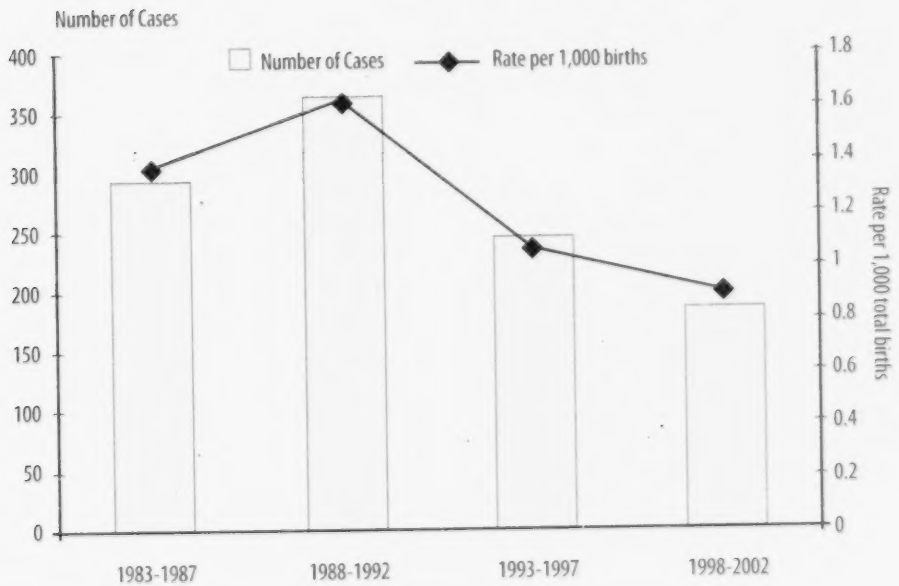
Benefits of Breakfast

For decades, the common wisdom has been that eating breakfast is better than going without, but few studies actually examined the impact on weight and nutritional status. The 1999 BC Nutrition Survey examined the relationship of eating breakfast with body mass index (BMI) and nutritional status of survey subjects.

It found that 85 per cent of participants consumed breakfast, with women slightly outnumbering men (87.5 per cent to 81.8 per cent). There was no difference in BMI between breakfast eaters and non-eaters; however, breakfast eaters consumed more fibre and more nutrients, particularly more of vitamins C, B6, and A, and iron, magnesium, calcium, phosporus, thiamin, riboflavin, and potassium (Barr, 2006).

Figure 1.5

Neural Tube Defects, BC, 1983-2002



Source: BC Vital Statistics Agency, Ministry of Health, Health Status Registry Report, 2002.

Although there are limitations to BC's data collection on neural tube defects, it appears that the BC rate has declined significantly since the mid-1990s, an indication of the results of the fortification of flour with folate and the inclusion of an appropriate amount of folic acid in multivitamins (Figure 1.5).

Baby's Best Chance

To ensure the best outcomes for mom and baby, the BC Ministry of Health produces Baby's Best Chance, a handbook given to all expectant mothers in BC. Now in its sixth edition, it provides a host of valuable advice on pregnancy and birth, including recommendations on what to eat for a healthy pregnancy and while breastfeeding. For more information, please refer to http://www.healthservices.gov.bc.ca/cpa/publications/babybestchance.pdf.

- **Folate (folic acid):** Found in leafy green vegetables, as well as in dried peas, beans and lentils, whole grain cereals, nuts, and orange juice, folic acid is an essential nutrient that has been linked to a reduction in birth defects, particularly neural tube defects (spinal cord, spina bifida, brain development) (Wharton & Booth, 2001). Inadequate folic acid intake has also been associated with congenital heart malformation, cleft palate, limb malformations, and digestive and urinary tract malformations (Czeizel, 1996; Shaw, O'Malley, Wasserman, Tolarova, & Lammer, 1995). While it is possible for a very careful eater to meet nutrient requirements through eating folate-rich foods, it is recommended that all women of childbearing age (teenage years through to menopause) take a 0.4 mg folic acid supplement daily, generally through a multivitamin.

  The recommendations include all women of childbearing age because it is critical that folic acid be taken prior to conception and in the first weeks of pregnancy. Even if a woman is not trying to conceive, a pregnancy is possible, and so it is critical that the supplement be taken by all women of childbearing age, not just those trying to conceive. The recommended supplement is 0.4 mg or more of folic acid daily at least one month prior to conception and throughout the first trimester.

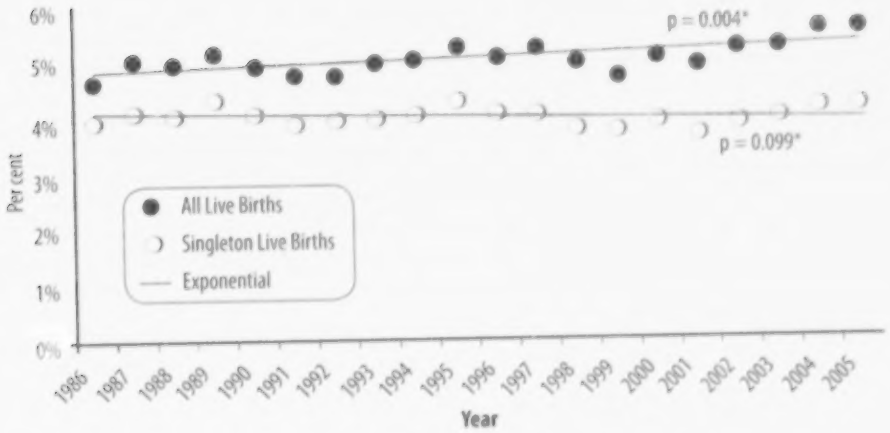
- **Calcium:** Calcium is necessary to build strong bones and tissues in the fetus and to maintain the mother's bone health. The previous recommendation of medical professionals was to substantially increase calcium intake during pregnancy. The new thinking arising from the release of the Dietary Reference Intakes is that calcium absorption adapts during pregnancy to help meet fetal needs, so that women need only to meet the minimum requirements for calcium for their specific age group. Many women do not meet these requirements and need to increase their intake by increasing consumption of milk products, calcium-fortified soy beverages, dark green leafy vegetables, and/or taking a calcium supplement if it is not possible to get enough calcium through foods and beverages.

- **Iron:** Many women start out their pregnancies with iron deficiency because of iron loss during menstruation combined with diets typically low in iron. Women's iron needs then increase during pregnancy, particularly in the second and third trimester, when both mother and fetus need iron for the development of blood supplies. A developing baby also stores iron for use after birth. A pregnant woman is advised to take an extra 5 mg of iron in the second trimester and 10 mg in the third trimester. It is difficult to consume that much iron through food; therefore it is recommended that pregnant women take iron supplements during pregnancy.

- **Essential Fatty Acids:** Derived primarily from vegetable oils, fatty fish, fish oils, and nuts and seeds, essential fatty acids are divided into two main groups: omega-3 and omega-6. They are essential for the healthy neural and retinal development of the baby. An amount of 1.4 grams per day of omega-3 and 13 grams per day of omega-6 is recommended for women during pregnancy (IOM, 2005).

Low Birth Weight Rates, Singleton and All Live Births, BC, 1986 to 2005

Figure 1.6



Source: BC Vital Statistics Agency
Prepared by: Population Health Surveillance and Epidemiology

* Log Linear Regression: All Live Births Slope = 0.005 (0.002 to 0.008 95% CI).
Singleton Live Births Slope = -0.003 (-0.006 to 0.001 95% CI).

Infants with low birth weight are more likely to have increased risk of illnesses, and/or poor health throughout childhood. Low birth weight is often associated with a higher chance of death within the first year of life. In British Columbia, the number of live births with low birth weight has increased in the last two decades. However, at the same time the number of multiple births, particularly for mothers over the age of 35, has increased significantly since the late 1980s. When we consider singleton babies, which constitute the majority of births, the rate of low birth weight babies has remained relatively stable since the late 1980s (Figure 1.6).

- **Adequate Fluids:** Pregnant and nursing women need to take in at least 1.5 litres of fluid daily, primarily from water and healthy beverages. Alcohol should be avoided completely.
- **Food Safety:** Food needs to be handled, stored, and cooked safely. Pregnant women should avoid raw or undercooked fish/meats, pâtés, soft or unpasteurized cheeses, many herbs, and unwashed fruits and vegetables, to avoid the common causes of food poisoning. Pregnant women, women of childbearing years, and young children should limit their consumption of predator fish such as shark, swordfish, or fresh (not canned) tuna to once per month, as there is concern over the levels of mercury in these fish (Health Canada, 1999).
- **Overall Weight Gain:** The recommended amount of weight gain varies according to the mother's pre-pregnancy body mass index level. For more information, please refer to: http://www.healthservices.gov.bc.ca/cpa/publications/babybestchance.pdf.

Along with eating a healthy diet, pregnant women should get adequate sleep and regular, low-impact physical activity. Smoking cessation and complete avoidance of all recreational drugs is essential. All prescription and over-the-counter drugs should only be taken under a doctor's supervision.

Low Birth Weight Rates

Infant weight at birth can tell us about the current and future health of the child, as well as the general health of the mother. Low birth weight is considered to be a weight below 2,500 g (5.5 lbs) for a newborn, and is often associated with premature birth (before 37 weeks gestation). Many complex, inter-related factors have a bearing on the birth weight

Canadian Journal of Public Health Supplement on Determinants of Healthy Eating

In 2005, a series of articles were commissioned by Health Canada's Office of Nutrition Policy and Promotion to further look at the determinants of healthy eating across Canada. The articles were published in a special supplement to the *Canadian Journal of Public Health* entitled *Understanding the Forces that Influence Our Eating Habits: What We Know and Need to Know* (2005). The papers highlighted the need for more research into the individual and collective determinants of healthy eating. Some of the many issues documented by the supplement and also identified as challenges to healthy eating in British Columbia are:

- The impact of advertising and mass media on choice.
- The relationship between socio-economic status and diet.
- Issues around aging and its impact on the ability to eat well.
- Barriers to healthy eating among Aboriginal people.
- The relationship of self-esteem and body image to food selection.

These important synthesis papers, combined with the results of the BC Nutrition Survey, offer a point from which to build and implement a broader strategy to enhance, promote, and support healthy eating in British Columbia and Canada. For more information, please refer to the website at: http://www.hc-sc.gc.ca/fn-an/alt_formats/hpfb-dgpsa/pdf/nutrition/volume_96-S3-e.pdf

of an infant, including overall nutritional and general health of the mother as well as prenatal care, age, economic status, ethnicity, partner abuse, fertility drug use, and smoking. Teenage mothers and first-time mothers over the age of 35 tend to have lower birth weight babies.

While the proportion of low birth weight babies born each year has remained stable for two decades, improvement can be made, particularly in some sub-populations such as Aboriginal families, and in specific regions of BC. For example, for the period of 1986 to 2002, the Vancouver Health Service Delivery Area had a greater prevalence of low birth weight infants than the provincial average for all years, except 2001. As data for low birth weight is recorded by the mother's usual residence, this higher prevalence is not a by-product of high-risk mothers coming to Vancouver's tertiary hospitals to give birth. Instead, it may be related to socio-economic factors, including low income, smoking by the mother during pregnancy, poor diet, pregnancy-induced hypertension, and multiple births. The trend of women postponing pregnancy until age 35 or older can also be a factor as these women are more likely to have pregnancy-induced hypertension and gestational diabetes.

Infancy and the Toddler Years: The Need for Extended Breastfeeding

Breastfeeding provides the essential nutrients for healthy growth and development and provides antibodies to protect against infection and allergies. Experts agree that human breast milk contains the optimal balance of nutrients needed for brain and body growth of young children (McCain & Mustard, 1999).

Recently both the World Health Organization and Health Canada released position papers recommending that women exclusively breastfeed until six months, and continue breastfeeding with complementary foods to two years of age and beyond. This recommended duration of exclusive breastfeeding represents an increase of two months from prior recommendations (WHO, 2004; Health Canada, 2004c).

The vast majority of babies in British Columbia are now breastfed for at least a few weeks of life. The National Longitudinal Survey of Children and Youth (Statistics Canada, 1999b) found that 93.1 per cent of children aged 0 to 5 years in BC were breastfed for at least some portion of life, compared to the Canadian average of 79.9 per cent.

The benefits of breastfeeding include:

- **Reduction in gastrointestinal infections:** Formula-fed infants and toddlers experience more frequent and severe stomach upsets and infections (Kramer et al., 2003).
- **Improved cognitive and motor development:** Preliminary research shows that children who are formula-fed do not perform as well on cognitive and motor development tests at 18 months (Morley & Lucas, 1997).
- **Appropriate growth, and potential reduction in obesity in future years:** Formula-fed children's growth patterns vary from breastfed children. An increasing body of research is showing a strong likelihood that breastfeeding may provide protection against obesity in childhood, adolescence, and adulthood (Dewey, 2003; Fewtrell, 2004).

- **Improved jaw and dental development:** Formula-fed infants have more problems with crowded teeth and typically experience more dental decay in childhood.

While the health benefits of breastfeeding are increasingly clear, the barriers or challenges to continued breastfeeding need to be examined in order to support longer duration rates. A return to work and unsupportive environments for breastfeeding are reasons women stop breastfeeding. In some cases, untrained or unsupportive health professionals may encourage a mother to stop. As noted in the 2002 Provincial Health Officer's Annual Report, more women might continue breastfeeding after six months if employment policies were more flexible or if a special room was set aside to enable nursing mothers to express milk at work (Provincial Health Officer [PHO], 2005).

Dietary Needs During Senior Years

As we age, our body processes slow down, reducing our need for calories and reducing our appetite. This can be a challenge for seniors, who often have increased needs for nutrients, but are often eating less calories. Individuals who are 70 years of age or older should ensure they have the following elements in their diet.

- **Nutritionally-dense food:** Due to a reduction in appetite, choices should include lean meats, whole grain foods, a wide range of dark green and orange vegetables, and milk products.
- **Increased fibre:** The elderly often suffer from constipation, so increasing fibre intake can improve digestive function.
- **Adequate hydration:** Since thirst, along with appetite, can decrease with age, the elderly often do not get the cues to tell them they are becoming dehydrated. The daily recommendation is for seniors to drink eight or more glasses of fluid from water, milk, juice, and soups, even if they do not feel thirsty. Fluids are also important in preventing constipation, particularly if fibre intake is increased.
- **Vitamins D and B12:** The ability to convert sunlight to vitamin D diminishes with age. The daily recommendation from the Dietary Reference Intake Standards is 800 IU. The ability to absorb vitamin B12 from food through the digestive process also diminishes with age. All individuals over the age of 50 are recommended to take a synthetic form of vitamin B12. The BC Nutrition Survey found that more than 50 per cent of all those 50 years of age and older did not take B12 supplements a month before the survey.

Social isolation and a decreasing ability or desire to prepare meals can be a barrier to healthy eating in seniors. This can be addressed by eating meals in groups, and other initiatives to ensure nutritious meals for seniors are easily accessible and enjoyable for all aging citizens.

Food Allergies

An estimated 4 to 8 per cent of children and 1 to 2 per cent of adults have one or more food allergies. Food allergies occur most often in families with a history of other allergic disease, such as asthma, eczema, and nasal allergies (Al-Muhsen, Clarke, & Kagen, 2003). A list of eight foods account for 90 per cent of all food allergies: cow's

▶ Keeping Well-Hydrated: Water is the Best Choice

An essential part of a healthy diet is consuming enough fluids to keep the body well-hydrated, particularly during physical activity or when temperatures are hot. Young children and seniors are most susceptible to dehydration, particularly through illness or high temperatures. Each person has different fluid needs, but the United States Institute of Medicine suggests 3 litres a day for a man and 2 litres a day for a woman (IOM, 2004).

Fluids can come from many sources, including milk, soups, coffee, tea, and juices in moderation. Sugary pops should be reduced or avoided completely. The best source of fluids is plain water.

You will know if you are consuming the right amount of water if your urine is typically a very light yellow, of normal quantity, and you feel well. Darker urine and less urinary output suggests you need to drink more water (Mayo Clinic, 2006).

▶ Sign Up for Allergy Alerts

Families and individuals with severe food allergies can sign up with the Canadian Food Inspection Agency (CFIA) to receive recall notices when allergens unexpectedly appear in foods.

All food manufacturers must list ingredients in their foods but sometimes during manufacturing, allergens such as peanuts may contaminate a product that is usually peanut-free. Through the CFIA, a recall is issued to immediately take the product off the store shelves. To subscribe to the free alerts, please visit: http://www.inspection.gc.ca.

Grapefruit Juice: Food-Drug Interactions

Grapefruits are healthy food choices, packing a lot of vitamin C, but research has found that they should not be consumed with a growing list of drugs, including heart and cholesterol medications, Viagra, some antihistamines, and antidepressants and anti-anxiety drugs.

A compound in grapefruit called furanocoumarin inhibits an enzyme in the small intestine, which can lead to a dangerous build-up of drug concentrations. Patients should consult with their pharmacist about possible grapefruit juice/drug interactions.

milk, eggs, soy, wheat, peanuts, tree nuts (walnuts, almonds, etc.), fish, and shellfish (Al-Muhsen et al., 2003). Symptoms of food allergies involve a variety of systems in the body. While the majority of food allergies are not life threatening, anaphylaxis is the most serious systemic reaction; it includes breathing difficulties, severe swelling of the throat, face, and appendages, and heart stoppage (Ellis & Day, 2003). Deaths from food anaphylaxis most often occur away from home when the individual consumes a food unknowingly and then delays or does not use an epinephrine injection (Sampson, Medelson, & Rosen, 1992).

All individuals with potentially fatal food allergies should carry an Epi-pen® (an auto-injector of epinephrine), read food labels very carefully, and strictly avoid the allergen. In the case of children with severe allergies, suspect foods such as peanuts may be restricted in the school setting, particularly in the youngest grades; however, researchers note that while this can reduce the chance of exposure, it does not eliminate it. Therefore, when children with severe food allergies attend a school, all staff must know how to identify and manage an anaphylactic reaction and have a wide range of other precautions in place (Canadian Society of Allergy and Clinical Immunology, 2005).

Other conditions such as celiac disease and lactose intolerance also affect between 1 and 5 per cent of the BC population.

- **Celiac Disease:** An autoimmune condition triggered in genetically susceptible individuals by eating the gluten in wheat, barley, and rye, celiac disease causes damage to the lining of the small intestine, typically causing diarrhea, bloating, and malnutrition. Up until about 10 years ago, it was thought to be quite rare, (1 in 3,000 individuals) but the introduction of a range of new blood tests has shown that the disorder is much more common, affecting at least 1 in 250 North Americans (Sander et al., 2001; Farrell & Kelly, 2002) and perhaps as many as 1 in every 111 people in the United States (Fasano, 2003; Israel, Levitsky, Anupindi, & Pitman, 2005). Many of these people may have very vague symptoms that bring them repeatedly to the doctor with complaints such as irritable bowel disease, infertility, patchy hair loss, anemia, depression, delayed puberty, and itchy skin blisters called dermatitis herpetiformes (Fasano, 2003). In absence of the typical symptom of diarrhea, it can take years for the disease to be properly diagnosed (Farrell & Kelly, 2002; Israel et al., 2005). Within two weeks of eating a gluten-free diet, and strictly avoiding food products that contain any wheat, barley, and rye or their derivatives, an individual with celiac disease will begin to show improvement (Farrell & Kelly, 2002).

- **Lactose Intolerance:** Lactose intolerance is an inability to digest the sugar lactose, which is a major component of milk and milk products. It arises in individuals with a deficiency in an enzyme called lactase, which breaks down lactose into glucose in the small intestine so it can be absorbed in the bloodstream. The individual has bloating, pain, gas, diarrhea, and intestinal discomfort, usually about 30 minutes after drinking milk or dairy products. Canadians of First Nations, African, or Asian descent have a higher prevalence for lactose intolerance than those of European descent. Those with

mild sensitivities can generally consume milk products, especially fermented ones such as yogurt and cheese, in small amounts with meals. For those with a stronger sensitivity, there are products available that contain an enzyme that breaks down lactose, making milk products accessible to all but milk-allergic individuals. Some people prefer to use calcium and vitamin D supplements to replace the key nutrients they are missing from their daily food intake. Given that osteoporosis is very common and the incidence is growing, it is crucial that British Columbians ensure they are getting adequate calcium and vitamin D.

Whenever a genetic disorder or food intolerance requires a person to limit a food group, a Registered Dietitian should be consulted to ensure that nutrient deficiencies are prevented. Dial-A-Dietitian is an excellent first contact for any questions about food intolerance or allergies. You can reach Dial-A-Dietitian at: 1-800-667-3438, or 1-604-732-9191 for Vancouver.

Physical Activity

Regular physical activity plays an essential role in complementing healthy eating and ensuring maximum health benefits. Eating healthy food goes hand-in-hand with moving our bodies, stretching our muscles, and increasing our heart rates on a daily basis.

Regular physical activity not only burns calories, thus preventing weight gain, but can also help delay or prevent many serious illnesses and chronic conditions. Physical activity improves sleep, increases energy levels, and helps reduce stress, anxiety, and depression. The health risks of inactivity include premature death, heart disease, obesity, high blood pressure, Type 2 diabetes, osteoporosis, stroke, depression, and colon cancer.

Although British Columbians are the most active in Canada, the majority are not active enough to benefit their health. The 1999 BC Nutrition Survey found that 61 per cent of participants did no strenuous activity, and 36 per cent did no moderate exercise during their leisure time. However, 80 per cent believed they were getting enough activity. This false belief creates a barrier to encouraging British Columbians to become more active (MOHP, 2003).

Genetic Disorders and Food

Favism: For people with a genetic mutation for an enzyme called G6PD (glucose-6-phosphate dehydrogenase), a simple dish of broad beans (fava beans) may provoke sudden destruction of red blood cells and lead to hemolytic anemia and jaundice and possible death. It is the most common enzyme disorder in the world, affecting primarily people in Africa, the Mediterranean, and Asia, and is thought to confer protection from malaria (WHO, 1989). People with the genetic mutation must be careful of certain drugs, particularly sulfa drugs and anti-inflammatories. For more information, please refer to the G6PD Deficiency Favism Association at http://www.g6pd.org.

Hemochromatosis: An inherited genetic disorder most common in people of Northern European descent, it causes too much iron to be absorbed from food, leading to iron build-up in organs, joints, and tissues, leading to debilitating and potentially fatal conditions such as diabetes, arthritis, liver and kidney damage, and even organ failure. It is the most common inherited disorder in Canada but is often undiagnosed. Treatment comes from limiting iron in the diet, removing blood in a series of sessions until blood iron is at normal levels, and then regular removal of a pint of blood every few months for life. People with the condition oppose the fortification of iron in common foods, such as cereals and bread. For more information, please refer to the Canadian Hemochromatosis Society at http://www.cdnhemochromatosis.ca.

Phenylketonuria: Phenylketonuria is a genetic disorder found in about 1 in every 15,000 births in BC. It creates a deficiency in an enzyme needed to break down a common amino acid, phenylalanine, found in almost all proteins. A screening blood test was created in 1964 and now every baby in North America is tested after birth. Those with the deficiency can lead a normal life if they eat a very low-protein diet, avoid aspartame, and take a specific amino acid supplement.

Galactosemia: This rare disorder (1 in 80,000 births) is a recessive genetic condition that leads to a deficiency in an essential enzyme that breaks down galactose, a milk sugar. All newborns are tested in BC and an infant who has inherited a gene from parents must be placed on a strict diet avoiding all lactose and galactose, mostly from dairy products. Although the child may lead a relatively normal life, long-term complications are still possible.

Canada's Physical Activity Guide

Health Canada, through the Public Health Agency of Canada (PHAC) and the Canadian Society for Exercise Physiology, has created an easy-to-use physical activity guide, similar in look to *Canada's Food Guide to Healthy Eating*. Featuring a similar colourful rainbow, the guide gives a pictorial representation of the types of endurance, flexibility, and strength activities Canadians should do on a regular basis.

The two-page guide, which is designed to be posted on a refrigerator, can be downloaded from the Physical Activity Unit of the PHAC website. Guides specifically aimed at children, youth, and seniors have also been created. For more information, please refer to: http://www.phac-aspc.gc.ca/pau-uap/paguide/.

Statistics Canada's National Population Health Survey and its Canadian Community Health Survey reported similar results; these surveys found that two-thirds of Canadians and 50 per cent of British Columbians are inactive. Among the most concerning finding is that 50 per cent of BC children are not active enough to obtain health benefits. Societal changes have meant that most children spend more time watching television and playing video games than playing outdoors.

Any physical activity is better than none at all and even 10 minutes of walking, 3 times a day, or taking the stairs instead of the elevator, can start sedentary people in the right direction. However, for adults, it is recommended that for maximum health benefits they should build up to 60 minutes of moderate, daily physical activity. If the activity is vigorous, 30 minutes, 4 times a week, can confer health benefits. Children should have 90 minutes of moderate to strenuous activity each day.

Adults should have a mix of the following physical activities:

- **Endurance (or aerobic) activities:** Four to seven days a week, adults should engage in continuous activities that raise the heart rate and condition the heart, lungs, and circulatory system such as climbing stairs, brisk walking, biking, swimming, dancing, jogging, or cross-country skiing.
- **Flexibility:** Four to seven days a week, adults should engage in gentle stretching, bending, and reaching to keep muscles and joints flexible and limber.
- **Strength:** Two to four days a week, adults should do resistance activities such as weightlifting or resistance training to strengthen muscle and bone and improve posture.

British Columbia has set the goal for 2010 of being one of the healthiest jurisdictions to ever host an Olympic Games. With our beautiful, natural physical environment, our relatively mild and inviting climate, and the huge range of physical activity available to us in the province, we should all make the effort to engage in some form of physical activity.

Summary

- Despite a host of different styles of healthy eating, the components of a healthy diet are very similar: lots of whole grains, fruits, and vegetables, with moderate amounts of healthy fats and lean protein, such as from milk products, nuts, seeds, fish, chicken, eggs, beef, beans, tofu, or other vegetarian protein sources.
- For more than 50 years, *Canada's Food Guide to Healthy Eating* has been helping Canadians make healthy food choices based on the best scientific knowledge of the day. The current revision of the Food Guide, now underway, will continue this tradition and attempt to reflect the changing nature of Canadian society.
- The determinants of healthy eating—why some British Columbians eat a more healthy diet than others—is highly complex and linked to a number of inter-related factors. Time, effort, knowledge, skills, education, age, socio-

economic level, family patterns, culture, and many other factors all link together to influence healthy eating.

- The three "macro" components of healthy eating—fats, carbohydrates, and proteins—have been the focus of extensive nutritional research in the past few decades. Now there is a growing understanding that some fats are healthy and an essential part of a healthy diet, particularly the essential fatty acids found in plant oils, fish, and nuts.

- Eating a small amount of lean protein at each meal can be more satiating and prevent rapid changes in blood sugar, which in turn can lead to the decreased consumption of calories.

- While common nutritional advice for decades has advocated that adequate micronutrients—vitamins, minerals, and phyotchemicals—can be consumed by eating a healthy diet, 50 per cent of British Columbians take a multivitamin or other supplement each day. The taking of supplements is important if individuals are consuming nutritionally inferior diets. Research is showing that a number of phytochemicals found in fruits and vegetables—such as beta-carotene and lycopene and other antioxidants—are beneficial to health and are best consumed not by supplements but by eating a diet rich in fruit and vegetables.

- The fortification of food supplies with micronutrients, such as iron, vitamin D, B vitamins, and folic acid, over the last 40 years has been a public health success story that has reduced disease and improved health. Health Canada is making revisions to fortification policies, which will give manufacturers more leeway to fortify foods (Health Canada, 2005a).

- At various stages in life, particularly pregnancy, breastfeeding, infancy, and senior years, individuals require specific nutritional advice. More calories and nutrients are needed to produce and feed healthy babies. Infants should be exclusively breastfed until 6 months of age and then breastfeeding should continue as part of the diet until at least 2 years. Seniors need more vitamin B, D, and calcium, and often need to use supplements to get their nutritional needs as their appetite declines.

- A diet that is healthy for most British Columbians can be unhealthy for some British Columbians, particularly those with allergies and conditions. To avoid nutritional deficiencies, registered dieticians should be consulted whenever a specific health condition restricts a specific food group, such as milk or wheat products.

- Physical activity—about 60 minutes of moderate activity for adults each day—is an essential complement to healthy eating.

Rx: 10,000 Steps

The journey to physical health could start with a journey of 10,000 steps every day. Walking 10,000 steps—about 8 kilometres—every day is becoming a popular fitness slogan in North America. All it takes is a good pair of walking shoes, a pedometer to measure steps, and the commitment to get out and walk. A number of research programs are now looking at the benefits (see http://www.canadaonthemove.ca), but already studies in both North America and Britain are finding that a pedometer may be a very effective motivational tool to show people their relative level of activity in a day and boost their activity to achieve greater health benefits (Dinger, Heesch, & McClary, 2005; Heecsh, Dinger, McClary, & Rice, 2005).

Shapedown BC

Shapedown BC is a comprehensive program for the assessment and [illegible]ment of childhood and adolescent obesity. Initiated by BC Children's Hospital in Vancouver, BC, *Shapedown BC* involves a team of health professionals – physicians, dietitians, mental health professionals and exercise specialists – who offer counselling and group sessions. The components of the program include medical assessments, 10–week program of one-on-one counseling, and education materials and resources on nutrition provided by counselling professionals.

Shapedown BC helps children, adolescents, and their families develop healthier attitudes towards nutrition and physical activity with the goal of achieving healthy weights. *Shapedown BC* has achieved positive results and is intended for implementation in all regional health authorities in the near future. For more information, please contact www.actnowbc.gov.bc.ca.

Chapter 2:
The Agriculture and Food Processing Sector in British Columbia

Only three per cent of BC's landmass is arable farmland. Nevertheless, that small proportion supports more than 200 different crop commodities. According to Smart Growth BC, a provincial non-governmental organization devoted to fiscally, socially, and environmentally responsible land use and development, BC's agricultural products meet more than 50 per cent of provincial food needs and offer many options for a nutritious, locally grown diet (Smart Growth BC, 2004). In 2001, there were 20,290 farms in BC covering 2.6 million hectares (Ministry of Agriculture and Lands [MAL], 2005). Agriculture is not just about producing food, however, as BC's agricultural sector also produces thousands of jobs and supports the BC economy. In 2004, total farm cash receipts reached $2.4 billion, and more than 297,000 people were employed in agricultural-related services (MAL, 2005).

BC's livestock sector, which includes dairy, cattle, hogs, poultry, eggs, honey, and fur and game-farm animals, accounts for 42 per cent of BC farm cash receipts. Distinct areas of the province are home to different types of livestock production. Hog, poultry, and egg production are primarily found in the Lower Mainland, while beef cattle ranches are concentrated in the Cariboo and north Thompson-Okanagan regions. Large dairy herds are mainly located in the Lower Mainland, southeastern Vancouver Island, and the Okanagan-Shuswap area. BC's dairy industry generates more revenue than any other component of the agricultural industry (MAL, 2005).

While not considered part of the agricultural sector per se, BC's seafood industry occupies a key place in the BC food industry and economy and is rightfully part of any discussion about food production in relation to food security. Commercial fisheries are the fourth largest primary industry in the province—after forestry, mining, and agriculture—and generate about $364 million annually. Seafood processing of both wild and farmed fish accounts for almost 20 per cent of the value of BC's food manufacturing industry (MAL, 2004b).

The province's aquaculture industry is steadily growing in importance, producing everything from farmed Atlantic salmon to Manila clams and Japanese scallops. Salmon, both wild and farmed, is by far the most dominant commodity in BC's seafood industry, accounting for 44 per cent of the total value of all of BC's seafood products. The annual total value of BC's seafood harvest, both farmed and wild, is almost $640 million, and processed seafood products fetch about $1.1 billion wholesale (MAL, 2004b).

Despite the abundance of food produced in BC, the province imports $3.5 billion worth of farm and food products (including fish) from other countries, and an additional $5.4 billion from other provinces. If food security were measured like trade deficits and surpluses, there would be an annual food security deficit of $1.9 billion with other provinces and countries (MAL, 2005). Importing large amounts of food affects food security by:

- weakening the local food-producing economy;
- removing support for BC farmers, and secondary producers and distributors;
- increasing the amount of "food miles" for each food item which adds to the environmental impact of the food; and

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BC Farming Facts

- Of BC's 94.78 million hectares of land and fresh water mass, only 3 per cent is suitable for agricultural use (MAL, 2004b).
- In 2001, BC had 20,290 farms covering 2.6 million hectares. Of this total, 618,000 hectares is in crops (MAL, 2005).
- About 61,000 British Columbians live on farms (1.5 per cent of the population) (MAL, 2005).
- More than 225 different agricultural commodities are produced in BC (MAL, 2005).
- Agriculture produces about $22 billion in consumer sales (MAL, 2005).

BC's Greenhouse Boom

BC has the third largest greenhouse production in Canada, after Ontario and Quebec.

In 2004, a total area of 2,310,844 m^2 was devoted to greenhouse production in BC. Ninety-five per cent of the greenhouse production is located on the Lower Mainland, with the remaining on Vancouver Island and the Interior. In 2004, 85 commercial greenhouses were in operation in BC. The principal crops grown include tomatoes, bell peppers, cucumbers, and lettuce. Different varieties of plants and flowers are also grown in BC greenhouses (Ministry of Agriculture, Food and Fisheries, 2003).

In 2005, total greenhouse sales were over $583 million—a significant increase from $403 million in sales in 2000 (Statistics Canada, 2000, 2005a).

- making the population more vulnerable to disruptions in food supply distribution.

Protecting BC Farmland and Supporting Farmers

Since only three per cent of BC's total land base is suitable for agriculture, it is important to make the best use of it to produce food and other agricultural products. The Agricultural Land Reserve (ALR) was established by the provincial government in the early 1970s, to ensure that land suited to agriculture was not developed or used for other purposes. Prior to the ALR's creation, BC lost 6,000 hectares of its best agricultural land each year to development (Smart Growth BC, 2005). The ALR currently includes about 4.7 million hectares of the best classes of arable soil on both Crown and private land (Provincial Agricultural Land Commission, n.d.). Boundaries have changed since the ALR's inception, but the size of the reserve has remained almost the same.

From the point of view of increasing BC's food security, it is noteworthy that not all land within the ALR is farmed. Farming is encouraged, and non-farm use is restricted, but significant tracts of ALR lands are idle due to a variety of factors. These include the economic challenges of farming, especially small-scale farming, and the rising price of real estate in many parts of BC, particularly in farming areas adjacent to fast-growing urban centres in southwestern BC and the Okanagan. On Vancouver Island, for instance, only about one-half of ALR land is currently used for agriculture (*Vancouver Island Agri-Food Action Plan and Trust Strategy*, as cited in MacNair, 2004).

The economics of farming in BC is particularly relevant to food security and puts the issue of ALR land in context. Protected agricultural land has little meaning if local farmers cannot make a living wage from farming it. Farmers are aging and it is difficult to find people to work in the fields, due to the low wages that farmers must pay in order to make a profit. In addition, property taxes and the cost of water for irrigation can be high. The cost of farmland, especially near urban centres, is so high that new farmers cannot afford to get into the business.

Idle ALR lands adjacent to fast-growing urban areas are especially vulnerable to development. At the time of this report, almost 4,000 acres of some of BC's best farmland were being considered for removal from the ALR for subdivisions and business parks (Smart Growth BC, n.d.). While cheap, imported foodstuffs are obviously desirable from a consumer perspective, there are other issues to be considered, including the benefits of local production, the loss of local jobs, and the environmental costs of "food miles."

To support a local food supply and provide healthy, nutritious food for the population, there must be an infrastructure in place that supports local farmers and food producers. Innovative pfograms such as the Linking Land and Future Farmers group and the Small Scale Food Processors Association help to foster this initiative.

The public also needs to be better informed about food production and why it matters to the economy, food security, and public health. The BC program, Agriculture in the Classroom, is an initiative designed to bring BC agriculture to students, and help young children understand the food system.

These types of initiatives will help protect farmland and make farming and food producing a viable form of employment in BC.

Food Imports: Pros and Cons

A century ago, most of the food consumed in BC was produced in the province; today, almost 50 per cent comes from outside the province. On Vancouver Island, the difference is even more pronounced. Just 50 years ago, 90 per cent of Vancouver Island's food was grown and processed by local farmers; today, only 10 per cent of the food eaten on Vancouver Island originates there (Haddow, 2001, as cited in MacNair, 2004).

Today, BC consumers can choose from a wide variety of foods for healthy meals. Rather than relying on canned, preserved, or frozen food during the winter months as previous generations did, most British Columbians can choose fresh, flavourful, and nutritious foods year-round, regardless of season. Indeed, consumers have come to expect that most types of fresh food will be available year-round, and think little of buying New Zealand apples, Chilean sea bass, and Peruvian asparagus. Imported foods often have larger scale production, lower labour costs, and longer growing seasons, which makes them cheaper than locally produced fare (MacNair, 2004). Packaged foods from across the globe are also available in BC in large quantities and varieties. The average supermarket in BC stocks 25,000 different items, and that number keeps growing.

Food Miles

The concept of food miles is used to measure how far food travels from producers to consumers. Food miles evoke not just the distance food has been transported, but also the underlying environmental, economic, and social costs of moving food ever greater distances from the farm gate to the dinner plate.

The seemingly limitless food choices come with a high environmental price tag. As the food transportation industry expands to keep up with global demand, the food supply chain consumes an ever-greater portion of non-renewable energy resources. The further food travels, the more it contributes to increased carbon dioxide emissions and global warming. One study of food consumption in Iowa found a significant transportation savings and a corresponding reduction of up to 7.9 million pounds in carbon dioxide emissions if just 10 per cent more of the produce consumed in Iowa originated in an Iowa-based regional or local food system (Pirog, Van Pelt, Enshayan, & Cook, 2001). When food travels long distances, extra packaging is often required, which uses fossil fuels for manufacturing and burdens waste disposal and recycling systems. A study in the United Kingdom found that the real cost of a market basket of food would be 11.8 per cent higher per week if the true cost of food miles in environmental and societal factors was included in the price (Pretty, Ball, Lang, & Morison, 2005).

Eating local food in season is the best way to minimize the environmental impact of food and increase food security. Local food, in season, is fresh, flavourful, and nutritious. Spinach and asparagus, for instance, lose 50 per cent of their vitamin C content within 24 hours after picking (MacNair, 2004). Buying locally produced food also makes it easier for consumers to trace exactly where their food comes from and how it is produced, improving

Making the Links

In 1994, a local organic farming community in Victoria started a non-profit organization called Linking Land and Future Farmers (LLAFF), which helps match small-scale organic farmers with landowners who would like their land to be farmed.

Although members must make their own matches, LLAFF offers other assistance to new farmers including a tool lending library, farming and education grants, sample leases, and partnership planning information. Information is available at (250) 361-1747 (mailbox 1).

Another new, innovative organization is the Small Scale Food Processors Association, a province-wide group that aims to help create value-added food products out of local food sources, such as specialty cheese out of local dairy products. One of its programs, called the living inventory, links producers with suppliers, such as a pumpkin pie maker with a local pumpkin grower. The organization not only supports regionally based, small-scale food processing systems, but advocates for supportive policies to foster the growth of small-scale food producers. For more information on the Association, please refer to their website at http://www.ssfpa.net.

Organic Farming in BC

BC leads Canada in organic farming. The province has an estimated 175 organic fruit farms, and 135 organic vegetable farms. Apples are, by far, the largest organic fruit crop in BC, with an estimated 719 acres under production; broccoli is BC's largest organic vegetable crop, with 124 acres devoted to its cultivation. BC has 12 non-organic fruit farms for every organic farm, and 14 non-organic vegetable farms for every organic one. That compares with a 62 to 1 ratio for fruit farms and 82 to 1 ratio for vegetable farms in Ontario (MAL, 2005).

confidence in the safety of the food system. With the burgeoning greenhouse production of fruits and vegetables in BC, buying local means fresh produce can be available out of the typical summer growing season. Moreover, consumer support of local and regional foodstuffs helps BC farmers stay in business, ensuring that healthy and abundant food will be available for future generations.

Consumers can help increase food security and minimize environmental impacts in BC by using their purchasing power to support BC farmers and fishers. The BUY BC program, launched in 1993 by the provincial government and private industry, aims to increase consumer recognition of BC products. More than 5,000 products with the BUY BC logo are now available at major grocery stores throughout the province. Surveys show that three-quarters of BC consumers recognize the logo. Various farming organizations and coalitions are creating logos or marketing strategies targeted at consumers throughout the province. Promoting products that are grown and processed in BC creates more job opportunities for British Columbians, reduces food miles, and strengthens the economy. For more information on Buy BC, please refer to their website at http://www.bcac.bc.ca/buybc/.

Summary

- BC has a relatively thriving and successful agricultural, food processing, and fisheries sector, but there are vulnerabilities such as idle, productive farmland, urban pressures on productive farmland, and an increasing difficulty for BC farmers to make a decent living working the land.
- BC's Agricultural Land Reserve, administered by the Provincial Agricultural Land Commission, has been preserving BC's best farmland for more than two decades. The *Agricultural Land Commission Act* must continue to reflect its purpose to preserve agricultural land despite existing pressures.
- BC imports more than 50 per cent of its food, which means that British Columbians have access to a wide range of fresh, nutritious foods at relatively cheap prices year-round. This reliance on imports, however, leaves the province vulnerable to potential disruption in the food supply by physical, economic, or political factors in other regions.
- Importing food also increases "food miles"—the distance food has travelled— which increases the environmental impact of that food, particularly through the use of non-renewable energy resources, excess packaging, and an increased contribution of carbon dioxide emissions.
- BC's food security can be strengthened by consumers using their purchasing power to buy BC-produced food products as often as possible.

Chapter 3: Impact of Unhealthy Eating

Diet and Chronic Disease

During the 20th century, a profound shift occurred in the predominant pattern of diseases that affected populations, especially in developed nations like Canada, the United States and some European countries. Infectious communicable diseases no longer represented the prime burden of disease, in a large part due to public health advances such as better sanitation, improved nutrition, immunizations, and the availability of antibiotics. Instead, non-communicable disease, specifically chronic diseases like cancer, cardiovascular disease, and respiratory disease, rose in prominence and now make up about 80 per cent of the disease burden in North America and about 50 per cent worldwide (World Health Organization [WHO], 2003b).

Sometimes, (and inaccurately) called "lifestyle diseases", many of the most prevalent chronic diseases have a limited number of risk factors, behaviours and conditions that contribute to their prevalence. Some of the risk factors, such as advancing age, genetic heritage, or gender, are not modifiable. But other risk factors—such as tobacco use, alcohol consumption, physical inactivity, diet, and the conditions and environments in which people live—can be changed. There is increasing scientific evidence that nutrition, physical activity, and other environmental factors may influence gene expression and therefore influence susceptibility (WHO, 2003b).

While this chapter focuses on the relationship between food choices and health, it is important to stress that from a public health perspective one must consider the interplay of all risk factors for diseases in context. For example, healthy eating and regular physical activity will be insufficient in reducing one's overall risk of cardiovascular disease or cancer if tobacco products are used. Obesity on its own is a significant risk factor for many diseases and arises when the amount of calories consumed is greater than the calories expended, no matter the source of those calories. The quality and not just the quantity of the fuel we put in our body matters to our overall health; one can be of normal weight, exercise regularly, avoid smoking, and still be unhealthy or at risk of chronic diseases because of eating nutritionally poor food (WHO, 2003b).

> ***Chronic diseases—many with diet as a prominent risk factor—now make up 80 per cent of the disease burden in North America***
>
> *(WHO, 2003b)*

The area of diet and chronic disease is an evolving science, which has many complexities. Unhealthy diets may take 30 or 40 years, or longer, to increase the risk of cancer, cardiovascular disease, or other chronic diseases, a time lag that makes studying the correlations highly complex. While tobacco-related cancers also tend to take decades to develop, the correlation is relatively simple and can be evoked by a simple question: *Did you smoke?* Diets, however, can be highly diverse and feature potentially hundreds of different food combinations. Studying the relationships between food and health relies on the recall of individuals or on responses in self-reported questionnaires, both of which can be unreliable (Willett, 2005). It is not surprising, therefore, that the medical and scientific literature is full of apparent contradictions.

Figure 3.1

Twelve Leading Causes of Death, British Columbia, 2004

Source: British Columbia Vital Statistics Agency, 2005

In 2004, as with previous years, malignant neoplasms (cancer) and cardiovascular disease were the leading causes of death in the province (Figure 3.1). More than 1 in 4 deaths (28 per cent) were due to malignant neoplasms, with the age-standardized mortality rate of 15.77 deaths per 10,000 standard population. Cardiovascular disease was the second leading cause of death, responsible for more than one-fifth of all deaths (23 per cent), with the age-standardized mortality rate of 11.38 per 10,000 standard population (British Columbia Vital Statistics Agency, 2005). There is a solid evidential basis to believe that over 50 per cent of different types of cancers and a large proportion of cardiovascular disease could be prevented through behavioural and environmental changes (Who, 2003b).

Since chronic disease tends to appear later in life, and dietary patterns change over a lifetime, it is also not clear whether certain time periods are more important than others for establishing risks for chronic disease. How significant are various eating patterns during infancy, early childhood, adolescence, and adulthood relative to each other? At this stage of our understanding we simply do not know (Frazão, 1999).

Despite these complexities, it is clear that poor food choices can be a significant risk factor for chronic disease. In 1988, the United States Surgeon General's *Report on Nutrition and Health* estimated that two-thirds of all deaths in the United States were due to diseases that had some association to diet. The Surgeon General also noted that for individuals who did not smoke and who drank responsibly, the single most important personal choice influencing long-term health was what they ate (United States Department of Health and Human Services, 1988).

Cancer

In 2004, cancer was the leading cause of death in British Columbia, claiming 8,401 lives (British Columbia Vital Statistics Agency, 2005). In 2003, there were 17,828 new cases of cancer, predominantly lung cancer and prostate cancer in men and lung cancer and breast cancer in women (Statistics Canada, 2005d).

It is estimated that more than 50 per cent of cancers could be prevented through lifestyle change. The largest preventable cause of cancer is tobacco use; however, it is estimated that one-third of cancers in industrialized nations are diet-related, making diet the second most important cause of cancer (WHO, 2005b). Regular physical activity, even at moderate or recreational levels, is associated with lower rates of some cancers, particularly colon cancer (Chao et al., 2004). Lack of adequate physical activity may account for 12 to 14 per cent of colon cancer (Slattery, 2004).

The role of diet in cancer has been suspected for decades, especially in light of the differing rates of specific cancers between countries. These epidemiological differences disappear when individuals of one heritage move to another country. For example, Asian women who lived in Asia were five times less likely to develop breast cancer than North American or European women (Muir, Waterhouse, Mack, Powell, & Whelan, 1987; Doll & Peto, 1981). However, Asian immigrants to North America have been shown to lose this advantage within one to two generations after relocation. It has been assumed that one of the key determining factors may be the difference in diet, although with so many variables in diets, confirming the specifics is difficult to study and remains contentious (Willett, 2005).

In 1997, the American Institute for Cancer Research and the World Cancer Research Fund released a comprehensive review of scientific evidence on what is known about diet, nutrition, and cancer (World Cancer Research Fund [WCRF] & American Institute for Cancer Research [AICR], 1997). This report estimated that changes in diet could prevent 50 per cent of breast cancers, 75 per cent of stomach cancers, and 75 per cent of colorectal cancers. A second edition of the report is being prepared for release sometime in 2006.

It is estimated that dietary factors account for approximately 30 per cent of cancers in western countries (Key, Allen, Spencer, & Travis, 2002); this link suggests that eating more fruits, vegetables, and whole grains, minimizing saturated fats and trans fats, maintaining normal weight, and exercising regularly throughout the entire lifespan could help reduce the risk of cancer. A diet rich in fruits and vegetables (especially high in folate) is key to preventing the formation of many cancers, particularly colorectal cancers (Strohle, Wolters, & Hahn, 2005).

High-Fat Diets and Cancer

For a long time it was thought that high-fat diets were linked to cancer, especially breast cancer, but a number of prospective studies have failed to demonstrate this link (Willett, 2005). This may be because "high-fat" is too general a label, as we now know that some fats (most plant fats) are beneficial and others are harmful (some saturated animal fats and all man-made trans fats). Recent research indicates that it may not be the fat itself, but rather that people who are eating high-fat food are not eating enough fruits and vegetables (Frazão, 1999; Willett, 2005). It could also be that high-fat diets tend to be high-calorie

Learning From Landmark Studies

Two large, long-term studies of specific populations—one following residents of a Massachusetts town and the other some 240,000 nurses in 11 American states—have done much to illuminate the relationship of diet and lifestyle choices to health. The two longitudinal observational studies are among the most important epidemiological studies in the world and together have spurred some 1,200 seminal research papers.

The Framingham Heart Study began in 1948, following 5,209 healthy men and women every 2 years; they were given comprehensive health exams, blood tests, and lifestyle questionnaires to elucidate the risk factors for cardiovascular disease. In 1971, 5,124 children of the original cohort were recruited for the "offspring" study. Now overseen by researchers at Boston University, the Framingham study has revealed a wealth of information about the impact of smoking, exercise, obesity, blood lipids, high blood pressure, and diet on cardiovascular disease and other chronic diseases (National Library of Medicine, 2005a).

The Nurses Health Study began in 1976, recruiting 122,000 married registered nurses between the ages of 30 and 55 to investigate the long-term consequences of oral contraceptives. The study was expanded to include a wide range of lifestyle issues on health.

Over the last three decades, the response has been greater than 90 per cent and in 1989 a second cohort of 116,686 younger nurses was added. Run by the Harvard School of Public Health, the study has produced more than 260 research papers about the relationships between diet, exercise, smoking, and hormonal factors to the risk of cancer, cardiovascular disease, heart attacks, stroke, diabetes, and other health problems in women (National Library of Medicine, 2005b).

Chronic Disease Management and Healthy Eating

Chronic diseases cannot be cured, but symptoms and complications can be greatly improved with good chronic disease management, including attention to diet. Chronic disease management promotes pro-active, evidence-based treatment by a team of health professionals, such as dietitians and therapists. An essential element is empowering patients to manage their disease themselves; for example, learning how to eat healthy for their condition.

For the last three years BC has been leading Canada in developing chronic disease management programs, including holding special patient self-management workshops throughout the province. The goal of patient self-management is to give the patient greater confidence in his or her ability to make a life-improving change. The process is taught through a free course, called "Living a Healthy Life with Chronic Conditions", which takes place in groups of about ten people with chronic disease, and is led by two people from the community, also with chronic disease, who have been specially trained to deliver the program. Patients attend for a total of fifteen hours over six weeks. Gradually they develop the skills to become informed, active patients who are able to manage the impacts of their illness on their functioning, emotions, and relationships.

The provincial government has funded the program until 2006 with $60,000 for each health authority. A toll-free number, 1-866-902-3737, can provide information about the locations and dates of the next round of courses. In-depth information is also available through the University of Victoria Centre on Aging, Chronic Disease Self Management website at http://www.coag.uvic.ca/cdsmp.

diets, leading to obesity, which is linked to increased cancer risk (WCRF/AICR, 1997; Willett, 2005).

Obesity and Cancer

Over the last few decades, studies have consistently linked obesity with a wide range of cancers. In one of the largest prospective studies of more than 900,000 American adults over 16 years of age, increased body weight was associated with increased death rates from all cancers combined and from cancers at multiple specific sites. In both sexes, being overweight or obese significantly increased the risk of death from cancer of the esophagus, colon, rectum, liver, gallbladder, and kidney, as well as from non-Hodgkin's lymphoma and multiple myeloma. Overweight or obese women had a higher risk of death from cancer of the breast, cervix, uterus, and ovary, while overweight and obese men had a higher risk of death from stomach and prostate cancer. The authors estimated that the current patterns of obesity in the United States could account for 14 and 20 per cent of all deaths from cancer in men and women respectively (Calle, Rodriguez, Walker-Thurmond, & Thun, 2003).

Childhood Diet and The Risk of Cancer

It is not yet clear how dietary choices in childhood and adolescence may influence the risk of cancer in later life. Large prospective studies that have followed adults have been unable to collect reliable data on eating patterns during childhood; however, the theory remains that an unhealthy diet in the formative years may promote DNA damage that may emerge as cancerous mutations later in life (Willett, 2005). The increasing rates of obesity in children also raises concerns about the potential for an increase in cancer rates in future years, since obese children tend to remain obese into adulthood and therefore will be exposed for a longer duration to potentially toxic compounds called adipokines that are secreted by fat. A high-calorie intake in childhood has been associated with an increased risk of cancer in later life even if the child obtains a normal weight as an adult (Frankel, Gunnell, Peters, Maynard, & Davey, 1998).

Cardiovascular Disease

Deaths from cardiovascular disease remain the second leading cause of death in British Columbia. In 2004, 6,697 people died of cardiovascular disease, accounting for one-fifth of all deaths in the province (British Columbia Vital Statistics Agency, 2005).

Cardiovascular disease includes a wide range of disorders of the heart and blood vessels, such as coronary heart disease, which includes myocardial infarction (heart attacks), angina, atherosclerosis (hardening of the arteries), stroke, transient ischemic attacks (mini strokes), hypertension (high blood pressure), and congestive heart failure.

Hypertension and diabetes increase the risk of coronary heart disease and stroke and are associated with dietary habits, particularly the high consumption of saturated fats, salt, and refined carbohydrates, and the low consumption of fruits and vegetables (WHO, 2003b).

Summarizing two decades of research, the 2003 World Health Organization report, *Diet, Nutrition, and the Prevention of Chronic Disease*, noted that there was good scientific evidence for the following in relation to cardiovascular disease:

- **Increased Risk of Cardiovascular Disease**
  Smoking remains one of the highest risk factors for cardiovascular disease. Consumption of trans fats (especially deep fried and baked goods), palmitic acid (a saturated fatty acid found in butter, cheese, meat, and coconut and palm oil), and myristic acid (another saturated fatty acid found in most dairy products), refined sugars, as well as high salt foods, are all risk factors. Being overweight or obese, physically inactive, and having a high alcohol intake also increases the risk of cardiovascular disease (WHO, 2003a).

- **Prevention of Cardiovascular Disease**
  Consumption of fruits and vegetables, fish and fish oils, and foods high in omega-3 oils and potassium, along with regular physical activity and low to moderate alcohol intake, can prevent heart disease. As noted in Chapter 1, consumption of polyunsaturated and monounsaturated plant oils that lower low density lipoprotein (LDL) and increase high-density lipoprotein (HDL) lower the risk of cardiovascular disease. There is reasonable evidence to believe that high-fibre diets (e.g., containing unsalted nuts, seeds, whole grains, etc.) can lower LDL cholesterol levels.

Diabetes

Diabetes is a chronic condition that results from the body's inability to sufficiently produce or use insulin, a hormone produced by the cells in the pancreas that regulates the storage and use of glucose in the body. The three main types of diabetes are Type 1, Type 2, and gestational diabetes.

Type 1 Diabetes

Type 1 diabetes, sometimes described as insulin-dependant diabetes, occurs mostly in children or adolescents. In Type 1 diabetes, the immune system attacks the insulin-producing cells in the pancreas and destroys them. As a result, little or no insulin is produced in the body. Individuals with Type 1 diabetes need daily injections of insulin to control their blood glucose. Scientists still do not know why the body's immune system attacks the cells in the pancreas; however, they believe genetic factors or viruses may be involved. Symptoms of Type 1 diabetes include thirst, frequent urination, constant hunger, weight loss, blurred vision, and fatigue. If this condition is not diagnosed and treated with insulin, patients could lapse into coma and could die (Health Canada, CCDPC, 2002).

Type 2 Diabetes

Type 2 diabetes is the most common type of diabetes and accounts for more than 90 per cent of the diagnosed diabetes cases. Type 2 diabetes typically occurs in people over 40 who are overweight or obese. Most individuals with Type 2 diabetes are insulin resistant[1]; however, by losing weight,

Physical Activity's Link to Health

Why are people who are more active usually healthier than those who are sedentary? It is not simply because they burn more calories and prevent obesity, but rather that regular exertion, like tuning an engine, has many physiological benefits, from the smallest micro-cellular level to large macro systems.

Although the process is not well understood, physical activity seems to prevent the following chronic diseases and illnesses:

- **Cancer:** increasing immunity and metabolism, increasing gut motility, regulating hormones, decreasing obesity.
- **Cardiovascular disease:** strengthening heart and lung function, increasing oxygen exchange, improving blood lipids, and increasing elasticity of arteries leading to lower blood pressure.
- **Diabetes:** increasing metabolic rate, decreasing body fat, moderating insulin, and improving glucose disposal and cell insulin sensitivity, potentially reducing diabetes by up to 60 per cent.
- **Osteoporosis:** strengthening muscles, enhancing bone density, improving flexibility, balance, and coordination, leading to fewer falls or injuries.
- **Mental health:** endorphins reduce stress, and relieve depression and anxiety (Bauman, 2004).

[1]Although insulin can attach normally to receptors on liver and muscle cells, certain mechanisms prevent insulin from moving glucose into these cells where it can be used. This is known as insulin resistance *(Health Canada, CCDPC, 2002, p 26-21)*

Reducing Risks of Cancer and Heart Disease by Consuming Leafy Green Vegetables

Spinach, kale, romaine lettuce, swiss chard, and collard greens have been shown to provide fibre, folate (a B vitamin essential for formation of DNA, the genetic material of the cells), and many different phytochemicals (plant chemicals protective against diseases), including carotenoids and flavonoids.

Studies in the United Kingdom and the United States have found that a diet rich in leafy green vegetables is associated with significant reductions in the risk of developing colon cancer and heart disease.(University of Liverpool, 2002; Harvard School of Public Health, 2004).

exercising, and taking oral medication, it is possible to overcome this resistance. The general symptoms of Type 2 diabetes include feeling tired and sick, frequent urination, excessive thirst, excessive hunger, and weight loss. Type 2 diabetes can also lead to a number of diseases such as cardiovascular disease (heart diseases) and microvascular diseases (kidney failure, blindness, etc.) (Health Canada, CCDPC, 2002).

Gestational Diabetes

Gestational diabetes occurs in some pregnant women and in most cases ends after birth. More than 40 per cent of women with gestational diabetes may develop Type 2 diabetes when they get older. Gestational diabetes should be treated with diet and/or insulin since the condition might adversely affect both the baby and the mother. Management includes screening, patient education, control of blood sugar, and perinatal monitoring (Health Canada, CCDPC, 2002).

It is estimated that approximately 2 million Canadians have diabetes, and around 40 per cent of these cases will develop complications. Factors that can lead to obesity, such as lack of physical activity and unhealthy eating habits, play a major role in the onset of Type 2 diabetes. Type 2 diabetes rates are 3 to 5 times higher in the Aboriginal population than in the general population in Canada (Health Canada, 2003b).

Figure 3.2

Projected Health Services Costs for Persons With Diabetes With Implementation of Lifestyle Modification Program, BC, 2003/2004 to 2015/2016

The direct costs for diabetes to the health care system in BC, including hospitalization, medical services plan and PharmaCare were about $1.04 billion in 2003/04. These costs could rise to $1.90 billion by 2015/2016 if the prevalence rate continues to rise at the current rate. However, if prevention initiatives can reduce the incidence of diabetes by just 25 per cent, an annual savings of over $200 million could be realized within 10 years. A 50 per cent reduction would result in an annual savings of over $400 million.

Note: For the purpose of this analysis, the resulting estimates were modelled from a widely reported study involving a nutritional and physical activity intervention for non-diabetics at risk of developing diabetes (Diabetes Prevention Program). It must be acknowledged that the results of a specific clinical trial are not necessarily attainable at the population level, but can assist in the development of goals for a population prevention strategy.

Source: Population Health Surveillance and Epidemiology, Ministry of Health, 2005.

The prevalence and incidence of diabetes is increasing in British Columbia. In 2004, in British Columbia, approximately 220,000 individuals—5.2 per cent of the population—were living with diabetes. Each year, approximately 20,000 British Columbians are newly diagnosed with diabetes and it is estimated that 4 out of 10 people with diabetes will develop complications such as blindness, kidney disease, cardiovascular disease, amputations, and reduced life expectancy (McParland, 2002). In BC, Status Indians have 1.4 times the prevalence rate of diabetes compared to other BC residents. The mortality rate among people with diabetes is more than twice as high as the rate among people who do not have diabetes. Over 6,000 individuals with previously diagnosed diabetes died in 2003/2004, accounting for over 20 per cent of all deaths in the province. The majority of these deaths are caused by diseases of the circulatory system and malignant neoplasms (cancers), which occur as a result of diabetes complications. Effective management of diabetes has been shown to result in the reductions in complications.

For more information on diabetes, please refer to the 2004 Provincial Health Officer's Annual Report, *The Impact of Diabetes on the Health and Well-being of People in British Columbia* at http://www.healthservices.gov.bc.ca/pho/.

Overweight and Obesity

Over the last 25 years, rates of overweight and obesity have increased dramatically worldwide, including Canada and British Columbia. The impact of this epidemic, which affects both adults and children, is profound in terms of its potential health and psychosocial consequences. Unfortunately, research shows that once an individual is overweight or obese, the tendency is to gain even more weight rather than lose it (Le Petit & Berthelot, 2005).

In 1997, the World Health Organization, in its seminal report *Obesity: Preventing and Managing a Global Epidemic*, called obesity "the greatest neglected public health problem of our time." It defined obesity as "a condition of abnormal or excess fat accumulation in adipose tissue to the extent that health could be impaired" and blamed the rising rates on an increasingly sedentary lifestyle combined with overconsumption of high-fat, high-calorie foods.

What is Body Fat?

Fat (adipose) tissue is a metabolically active endocrine organ that secretes numerous hormones and cytokines—compounds used in cell-to-cell communications. Adipokines (the proteins produced by fat tissue) have been the subject of intense research in recent years and are being cited as important factors in inflammatory processes, insulin resistance, blood pressure regulation, immune system regulation, and other processes (Wisse, 2004; Rudin & Barzilai, 2005; Trayhurn & Wood, 2004). It is now clear that adipose tissue is very complex and is involved in moderating appetite, metabolism, and other physiological processes. Various adipokines secreted by fat may be the reason that obesity itself is linked to so many disease processes (Trayhurn & Wood, 2004).

Understanding Body Mass Index

Body mass index (BMI) is the standard measure used to categorize overweight

Metabolic Syndrome

Research over the last decade has found that a cluster of disorders of the body's metabolism is a warning of heightened risk of developing cardiovascular disease, stroke, or diabetes. The clustering of metabolic symptoms are:

- Obesity, particularly around the abdomen;
- High blood pressure;
- Abnormal cholesterol levels (high total cholesterol or triglycerides, or low HDL, the "good" cholesterol);
- Insulin resistance, in which certain mechanisms prevent insulin from moving glucose into liver and muscle cells where it can be used (Health Canada, Centre for Chronic Disease Prevention and Control [CCDPC], 2002).

While each of these disorders itself is a risk factor for disease, having one or more of them in combination dramatically increases the risk of developing a serious, life-threatening disease. It is concerning that the incidence of metabolic syndrome in obese children and adolescents is increasing (Weiss et al., 2004; Engelmann, Lenhartz, & Grulich-Henn, 2004).

More research is needed about how aggressively metabolic syndrome should be managed medically. Currently, according to the American Heart Association, the preferred method of control is to lose weight and increase physical activity (Mayo Clinic Staff, 2004; American Heart Association, 2004).

Cost of Obesity in British Columbia

The annual cost of obesity to the health care system in British Columbia in 2000 was estimated to be $380 million per year (Colman, 2001). This figure includes the amount spent on doctors' fees, hospitals days, and pharmacare costs.

The analysis noted the total cost to BC is much higher when indirect costs of missed days of work, poor quality of life, disability, decreased productivity, and premature death are included. The study estimated the total cost could be as high as $830 million per year, second only to tobacco.

However, the analysis probably underestimates the true cost of obesity for a number of reasons. The analysis used old rankings of body mass index (BMI), which puts the threshold for overweight and obesity at BMI 27 or higher as opposed to 25. It also based the estimates on self-reported data rather than directly measured BMIs. As a result it tallied the cost of obesity based on the estimate that 29 per cent of British Columbians were overweight or obese—rather than the 55 or 60 per cent from the latest BC Nutrition Survey and Statistics Canada findings respectively (Tjepkema, n.d.).

and obesity both at the individual and population level. Body mass index is calculated by taking a person's weight in kilograms divided by height in metres squared. Individuals with a BMI of 25-29.9 are considered overweight, and those with a BMI of 30 and above are considered obese.

Underweight <18.5
Normal 18.5 - 24.9
Overweight 25 - 29.9
Obese >30

Individuals with BMIs of 25 or greater generally have a higher risk of metabolic syndrome, diabetes, coronary heart disease, stroke, cancer, gall bladder disease, arthritis, and other health problems; the higher the BMI, the greater the risk of health problems. Statistics Canada has categorized obesity risks into three classes: Class I (BMI 30-34.9), Class II (BMI 35-39.9), and Class III (BMI >40). Those with a BMI of 40 or above have extremely high rates of health problems and in the past were called morbidly obese.

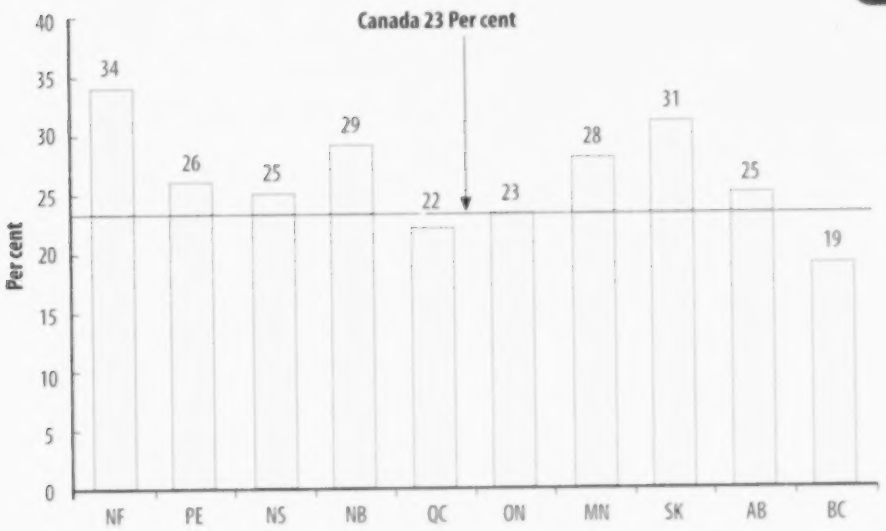
Body Mass Index Limitations

Given that BMI is based on a calculation of body measure, it is not recommended for use in certain populations, as it may not be a true reflection of their health risks. Some of the inaccuracies include:

- **Certain body types:** Athletic, muscular individuals will weigh more and have a higher BMI that does not reflect their true health risk. Individuals who are very lean, very tall, or very short may also have inaccurate BMIs (Tjepkema, n.d.).
- **Growing children and adolescents:** As children grow and develop, their BMI changes and their rates of overweight and obesity do not correspond to the adult categories. Canada has adopted the US Centers for Disease Control growth charts, recently updated and released in 2000. The revised growth charts provide an improved tool for evaluating the growth of children based on the growth of both breastfed and formula-fed babies in the US. BMI is the most commonly used approach to determine if adults are overweight or obese and is also the recommended measure to determine if children are overweight. The new CDC BMI growth charts can be used clinically beginning at two years of age, when an accurate stature and date of birth can be obtained.
- **Ethnic groups:** The BMI rate can misjudge the risk of obesity-related health complications in non-European populations. Studies have shown people of Asian, South Asian, and Aboriginal heritage may have a higher risk of health problems at lower BMI measures, while individuals of African descent may not see health problems until a BMI surpasses 26 (Razak et al., 2005). Some have called for BMI rankings to be revised for non-Europeans, setting thresholds of BMI 23 (overweight) and BMI 26 (obese) for Asian populations, and BMI 26 (overweight) and BMI 32 (obese) for those of African descent (Razak et al., 2005).
- **Elderly:** As people age they lose muscle mass, making them lighter but not necessarily leaner. BMI can misclassify them as being in a healthy range when their actual fat levels put them at risk of health problems.

Rates of Obesity, Adults 18 and Over, Canada and Provinces, 2004

Figure 3.3

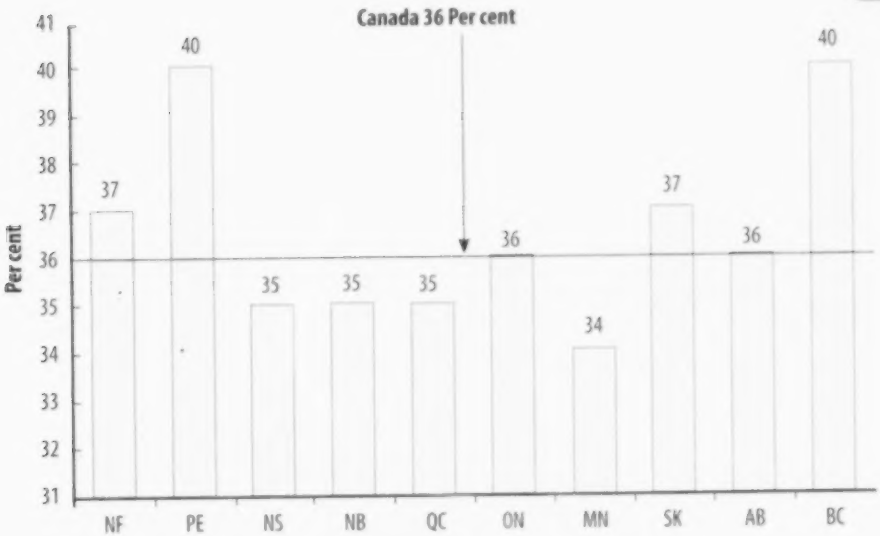


Source: Statistics Canada. 2004 Canadian Community Health Survey.

British Columbia had the lowest rates of obesity in Canada; nevertheless, 19 per cent of those 18 and older were obese, with BMI of 30 or greater. Newfoundland had the highest rate of obesity at 34 per cent. The overall rate of obesity for Canada was 23 per cent. (Figure 3.3)

Rates of Overweight, Adults 18 and Over, Canada and Provinces, 2004

Figure 3.4



Source: Statistics Canada. 2004 Canadian Community Health Survey.

British Columbia had more people who were overweight than all other provinces except Prince Edward Island. Both provinces had an overweight rate of 40 per cent. The overall rate of overweight adults in Canada was 36 per cent. (Figure 3.4)

Self-Reported as Opposed to Measured

Most people overestimate their height and/or underestimate their weight when filling out questionnaires or answering telephone surveys. Women tend to underestimate their weight, while men tend to overestimate their height (Tjepkema, n.d.). This natural tendency leads to the reporting of lower BMI numbers and underestimates the prevalence of overweight and obesity in the population. When health professionals directly measure and weigh survey populations, the reporting errors are removed.

In Canada, most surveys of obesity since 1978 have been self-reported. However, the 1999 BC Nutrition Survey directly measured and weighed its 1,823 participants, finding that 55 per cent were overweight or obese, significantly higher than previous estimates.

In 2004, for the first time in 26 years, the Canadian Community Health Survey nationally measured and weighed respondents. The results showed that almost 60 per cent of Canadians were overweight or obese (Tjepkema, n.d.).

Despite the limitations of BMI, it is the most convenient and efficient method available to screen populations for overweight and obesity trends and to compare Canadian population rates historically, currently, and to other countries. However, due to its weaknesses, BMI should not be used as the sole method to screen individuals in terms of obesity-related health problems. Other important elements should also be considered, including the following:

- **Waist size:** in women, waists larger than 76.2 cm (30 inches) generally correspond to being overweight and waists over 88 cm (35 inches) correspond to being obese. For men, the measures are 88 cm (35 inches) for overweight and 100 cm (39.5 inches) for obese. This tool is currently recommended for use in conjunction with BMI.
- **Medical tests where warranted:** For individuals with risky BMIs or high waist circumference, tests for high blood pressure, blood lipid levels, and blood sugar levels can confirm elevated health risks such as metabolic syndrome and diabetes.

Rising Obesity Rates in BC and Canada

In July 2005, Statistics Canada released a report confirming that obesity rates are at an all-time high in Canada. The results were obtained from the 2004 Canadian Community Health Survey (CCHS) that directly measured the heights and weights of 8,661 Canadian children aged 2 to 17 and 12,428 Canadian adults 18 and older. The last time a national survey measured heights and weights was in 1978/1979. The 2004 results revealed that obesity is more prevalent than predicted. The CCHS survey results were released in two separate Statistics Canada reports in July 2005, one reporting the results for adults and the other for children. A comparison of these two surveys is provided in the following section.

Overweight and Obesity in Adults

- In 2004, 23 per cent of adult Canadians were obese, with BMIs of 30 or greater, compared to 14 per cent in 1978/1979.
- In 2004, 36 per cent of adult Canadians were overweight (BMI 25 +), compared to 35 per cent in 1978/1979.
- The combined rates of overweight and obesity mean that almost two-thirds (59 per cent) of Canadians had a BMI of 25 or greater in 2004. In 1978/1979, 49 per cent of Canadians had a BMI greater than 25.
- The most striking increases in obesity for adult Canadians were in the 25-34 age group and 75 and older age group, where obesity rates doubled to 21 per cent and 24 per cent respectively.
- Obesity rates peaked among individuals age 45 to 64, with 30 per cent having a BMI of 30 or greater. Obesity rates were lowest at 11 per cent for adults of both sexes between the ages of 18 and 24.
- Diet was a factor in obesity rates. Men and women who ate fruits and vegetables less than three times a day were more likely to be obese than those who consumed those foods five or more times a day. This association persisted even when age and socio-economic status was taken into account.

Obesity Rates, Ages 2-17, Canada and Provinces, 2004

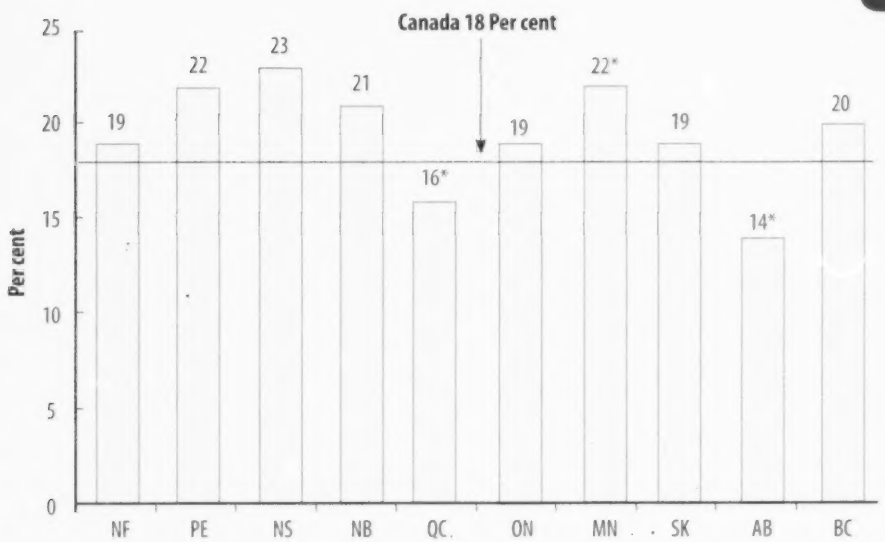
Figure 3.5

*Coefficient of variation between 16.6% and 33.3% (interpret with caution)
Source: Statistics Canada. 2004 Canadian Community Health Survey.

BC had the lowest obesity rates for children and adolescents at 7 per cent and Newfoundland had the highest at 17 per cent. Canada's overall rate was 8 per cent (Figure 3.5).

Overweight Rates, Ages 2-17, Canada and Provinces, 2004

Figure 3.6



*Coefficient of variation between 16.6% and 33.3% (interpret with caution)
Source: Statistics Canada. 2004 Canadian Community Health Survey.

In 2004, 20 per cent of children and adolescents were overweight in BC. The province with the highest rate was Nova Scotia (23 per cent). Canada's overall overweight rate was 18 per cent (Figure 3.6).

- The level of physical activity was also a factor in obesity; 27 per cent of both males and females who were sedentary were obese and 39 per cent were overweight.
- New immigrants to Canada tended to be the least obese, but that "healthy immigrant" effect was lost within one or two generations.
- Being overweight or obese was a risk factor for a number of chronic conditions. As BMI increased, so did the likelihood of having high blood pressure, diabetes, and heart disease.

Overweight and Obesity in Children and Adolescents

- The obesity rates for children and adolescents (2 to17) increased from 3 per cent in 1978/1979 to 8 per cent in 2004.
- 18 per cent of children and adolescents were overweight in 2004, compared to just 12 per cent in 1978/1979.
- Combining the rates of overweight and obesity showed that in 2004, 26 per cent of Canadian youth were overweight or obese, compared to just 15 per cent in 1978/1979 —a 70 per cent increase.
- Over the past 25 years, the rate of obesity for adolescents aged 12 to 17 has tripled from 3 per cent to 9 per cent. The combined overweight/obesity rate for this age group increased from 14 per cent to 29 per cent.
- Diet was a factor in obesity rates as youth who ate fruits and vegetables more than five times a day were substantially less likely to be obese.
- Physical activity and sedentary pursuits were also related to rates of overweight and obesity. The more hours of "screen time" youth spent watching television, playing video games, or using the computer, the more likely they would be overweight or obese.

Overweight/Obesity, Inactivity, Smoking and their Associated Increased Health Care Costs in the BC Population

A preliminary analysis of a sample of 7,694 BC residents, 25 years of age and older,[1] assessed the risk factors of overweight/obesity, physical inactivity, and smoking,[2] as well as their associated health care costs. Only 18.6 per cent of the individuals had no risk factors, 37.9 per cent had one risk factor, 32.1 per cent had two risk factors, and 11.4 per cent had all three risk factors. Furthermore, a substantial majority (68.6 per cent) had physical inactivity and/or overweight/obesity as risk factors (Figures 3.7 and 3.8).

In this preliminary analysis, the average annual age-adjusted per capita health care cost for those with no risk factors was $1,003, increasing to $2,086 per capita[3] for individuals with all risk factors (smoking, overweight/obese, and physically inactive). In general, the cost data show a consistent pattern of increasing costs from one to two risk factors with the greatest costs associated with all three risk factors. It is notable that the inactive individuals had similar costs to the overweight/obese smoker individuals. The final bar on Figure 3.9 shows the relative costs for those who have one or more risk factors.

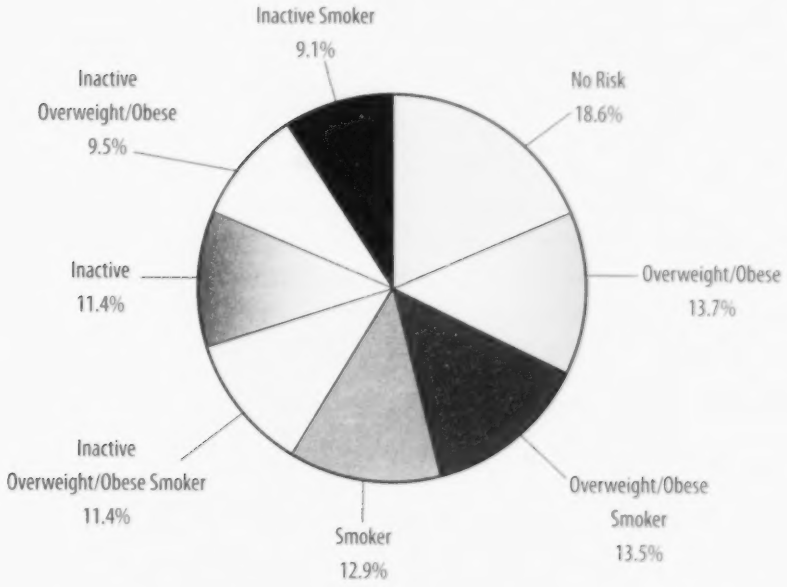
[1]The 7,694 sample was from the 2003 Canadian Community Health Survey (CCHS) and included those individuals 25 years of age and older who responded to three risk factor questions (smoking, body mass index, activity level), who had a valid Personal Health Number (PHN), and who also gave permission for their health records to be linked with other databases for research purposes, in an aggregated manner to protect personal privacy. The analysis used the CCHS Share File with Bootstrap Weights for PHNs as provided by Statistics Canada. Excluded from Figures 3.7 and 3.8 were another 428 persons who did not respond to at least one of the risk factor questions, or who were underweight (BMI < 18.5), or who were in certain inapplicable other categories.

[2]Smokers included those who were current or former daily smokers. Overweight/obese persons included those who had a Body Mass Index (BMI) of 25 or greater. Persons categorized as inactive were those whose responses indicated that regular physical activity was not currently part of their lifestyle.

[3]For each person, costs for three years (2001/2002 to 2003/2004) were aggregated from the three sources (hospital, Medical Services Plan, and PharmaCare). The Medical Services Plan and PharmaCare costs are actual amounts paid for medical services and prescriptions. Hospital costs are estimated using average cost per weighted case figures for BC in each of the three years. The annual average total cost is the total costs for the three years divided by three.

Figure 3.7

Proportion of Sample with Personal Health Numbers by Risk Cohort, Ages 25 and over, BC, 2003

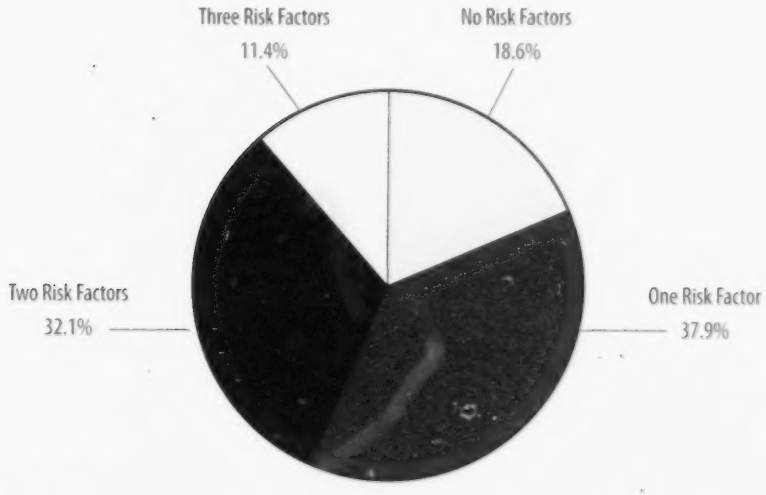


Out of 7,694 BC population sample size, 18.6 per cent had no risk factors. About 48 per cent were overweight/obese, about 47 per cent were current or former daily smokers and about 41 per cent were inactive (Note: these categories overlap).

Source: Population Health Surveillance and Epidemiology, Population Health and Wellness, BC Ministry of Health, 2006.

Figure 3.8

Proportion of Sample with Personal Health Numbers, by Number of Risk Factors, Ages 25 and over, BC, 2003



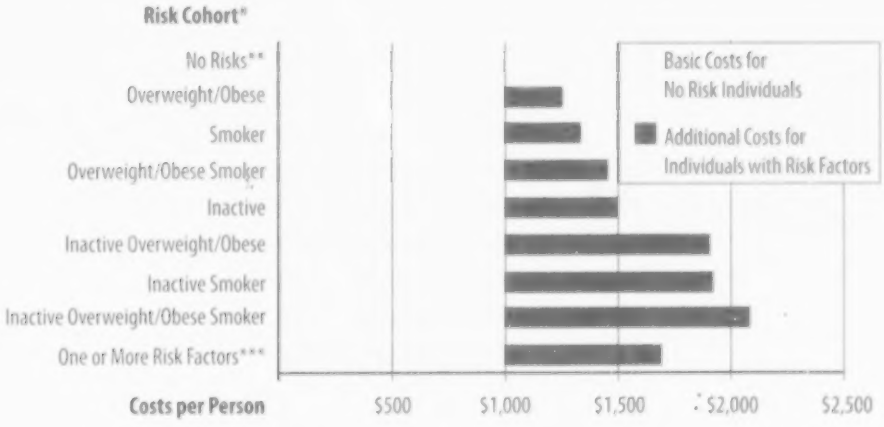
In assessing the risk factors of overweight/obese, inactivity, and smoking, only 18.6 per cent had none of the risk factors. Close to 38 per cent had only one risk factor.

Source: Population Health Surveillance and Epidemiology, Population Health and Wellness, BC Ministry of Health, 2006.

Figure 3.9

A Preliminary Estimate of Average Annual Age-Adjusted Per Capita Costs (Hospital, MSP, PharmaCare) for Ages 25 and over, by Risk Cohort, BC, 2001/2002 to 2003/2004

Based on the BC sample population of 7,694, approximately $1.8 billion in health care costs can be attributed to overweight/obesity, physical inactivity, and smoking.



*Based on CCHS 2003 sample for BC who provided a valid Personal Health Number and permission for data linkage.

**Never Daily Smoker, BMI 18.5-24.9, Physically Active or Moderately Active.

***Includes 428 individuals who were non-responders for one or more risk factors, underweight persons, and certain inapplicable other categories.

Source: Population Health Surveillance and Epidemiology, Population Health and Wellness, BC Ministry of Health, 2006.

Guidelines for Food and Beverage Sales in BC Schools

British Columbia has recently introduced "Guidelines for Food and Beverage Sales in BC Schools" to help eliminate junk food and improve student health. These voluntary guidelines will help schools to divide food and beverages into four categories: choose most, choose sometimes, choose least, and not recommended. The aim of this program is to discontinue sales of "not recommended" items, and move toward selling "choose most" and "choose sometimes" items.

In summary, persons with one or more of the risk factors (overweight/obesity, physical inactivity, and smoking) comprised 81.4 per cent of the sample population (of whom 68.6 per cent were overweight/obese and/or physically inactive). Age-adjusted health care costs for persons with one or more of these risk factors were 69 per cent higher than for persons with none of the risk factors. Cumulatively, if the experience of the individuals in the sample is projected onto the provincial population, 36 per cent of health care program costs (hospitals, MSP, and PharmaCare) are attributable to these risk factors.

Therefore, based on this preliminary analysis and 2004/2005 costs of $4.9 billion,[3] incurred for the population aged 25+ years, it is estimated that approximately $1.8 billion in health care costs can be attributed to overweight/obesity, physical inactivity, and smoking in the BC population (Figure 3.9). Further research is planned to incorporate the data from the 2000/2001 and 2005 Canadian Community Health Survey samples into the analysis, to allow a more detailed assessment of individual risk factors and costs by age, gender, and region.

The Obesogenic Environment

On the surface, the cause of obesity is straightforward: more calories are consumed than are burned off through physical exertion. Maintaining a steady weight is an equation in which the number of calories eaten in the form of food or drink must be equal to that used

[3] *Cost estimates based on hospital programs ($2.7 billion), Medical Services Plan ($1.5 billion), and Pharmacare ($0.7 billion), incurred by BC residents aged 25+ years.*

as fuel during physical movement and body processes. Any imbalance in the equation will result in either weight gain or weight loss. To lose weight, people must consume fewer calories or expend more energy.

We know that the growing rates of obesity cannot be placed only on the shoulders of individuals. Obesity is highly complex and has elements of genetics, cultural behaviour, and psychology. In addition, certain environments or social trends can make it more likely that obesity will result. Some have identified these environments as the "obesogenic" environment. The obesogenic environment has been defined as an environment with a sum of influences that promote obesity in a population (Swinburn, Egger, & Raza, 1999).

It is clear that a number of profound changes to human culture, in relationship to food and physical exertion, have occurred over the last three decades. Since genetic change does not occur in such a short time frame, it is reasonable to conclude that changes in environment underlie the obesity epidemic and it is through environmental modification that this epidemic will be reversed.

Changing Patterns of Food Consumption

What we eat and the way we eat has changed over the last three decades. These changes include:

- **More convenience, restaurant, and prepackaged food:** With many families consisting of two working parents, or single parents, the prevalence of home-cooked meals made from scratch is diminishing. More families choose prepackaged or convenience foods to help get a meal on the table when they come home. Takeout meals like pizza have also increased, as have meals outside the home (Sturm, 2005a).
- **More high-calorie drinks:** Soft drink consumption has doubled in North America since the mid-1970s (Enns, Mickle, & Goldman, 2002; Murray, Frankowski, & Taras, 2005; Sutherland, 2004). A 355 ml serving of pop may contain between 10 to 12 teaspoons of sugar and between 140 to 160 calories. Children in particular are drinking more sugary drinks than ever and this replaces other more nutritious drinks such as milk, fruit and vegetable juice, and water. One of the many findings of the Harvard School of Public Health Nurses Health Study was that

BC's Healthy Living Alliance

In 2003, a coalition of more than 20 different health-related organizations, such as the BC chapters of the Canadian Diabetes Association, Cancer Society, and the Heart and Stroke Foundation, and regional health authorities joined forces with provincial and municipal governments to help improve preventive health in BC. Recognizing that behind most chronic diseases are four common risk factors—poor diet, inactivity, obesity, and tobacco use—the Alliance's mission is to improve the health of British Columbians through leadership that enhances collaborative action to promote physical activity, healthy eating, and living smoke-free.

The primary focus of the Alliance is to address not only the common risk factors, but to begin to address the underlying determinants, such as socio-economic status and education, that contribute significantly to cancer, cardiovascular disease, chronic respiratory disease, and diabetes. The Alliance has set the following targets for 2010:

- 9 out of 10 British Columbians will be non-smokers.
- 7 out of 10 British Columbians will consume five or more fruits and vegetables each day.
- 7 out of 10 British Columbians will be physically active.
- 7 out of 10 British Columbians will be at a normal weight.

The coalition emphasizes that government policies need to make healthy choices the easy choices for British Columbians. The collaboration brings together a number of BC ministries, health organizations, and a wide array of community participants and organizations to create a network that will link more than 25,000 volunteers throughout the province to help change the lifestyle-related behaviours that are making us ill.

In March 2006, the BC Ministry of Health announced an additional investment of $25.2 million to the BC Healthy Living Alliance. For more information on the Alliance, please refer to their website at: http://www.bchealthyliving.ca/.

Old Order Mennonite Children: Leaner, Fitter, Stronger

A recent Canadian study gives credence to the theory that our contemporary lifestyle is fuelling the obesity epidemic.

Research by obesity expert Dr. Mark Tremblay and a team from the University of Saskatchewan and the University of Lethbridge compared children raised in Old Order Mennonite communities, who live much as our grandparents did, to children in urban and rural communities of Saskatchewan. The study found:

- Mennonite children had no physical education class and did no organized sports but had leaner triceps, stronger grip strength, and greater aerobic fitness than children raised in a more contemporary environment.
- Mennonite children did 18 minutes more physical activity each day through walking and traditional farm and household chores.
- The researchers estimated the difference in activity levels would account for 15,000 fewer calories, or about 4 fewer pounds a year and 40 fewer pounds between the decade from childhood to adolescence (Canadian Institute for Health Information, 2005).

women who drank one sugary beverage a day had an 80 per cent higher risk of gaining weight and developing Type 2 diabetes than women who consumed less than one sugary drink a month (Schulze et al., 2004).

- **Larger portions:** Since the 1970s, standard portion sizes have increased in almost all food groups in both restaurants and home (Nielsen & Popkin, 2003; Young & Nestle, 2002; Nestle, 2003). Research in the United States which looked at portion sizes sold as single servings in convenience stores, fast-food establishments, and chain restaurants showed that the portion size of many common foods including soft drinks, hamburgers, and hot dogs began to grow in the 1970s, rose sharply in the 1980s, and has continued to rise in parallel with increasing body weights. Some current portion sizes are more than twice the size of portion sizes from the 1970s.
- **More carbohydrates in relation to fats and proteins:** Some public health officials have noted that the beginning of the obesity epidemic coincides with the beginning of the message from public health, the American Heart Association, and others to eat a lower fat diet. This generally sound advice may have had the negative side effect of encouraging people to eat proportionally more calories from simple carbohydrates. Trends show that fat consumption for children fell by about 100 kcal, but at the same time carbohydrate consumption increased by about 150 to 200 kcal (Enns et al., 2002; Sturm, 2005b). Since protein and fat are more satisfying, some speculate that avoiding fats made us hungrier, which then translated into more calories consumed from carbohydrates (Taubes, 2002; Ludwig, 2005).
- **More food choices:** As noted in Chapter 1, too much choice, even if it is healthy, can promote weight gain because both humans and animals alike tend to overeat when surrounded by many tempting tastes, but reach satiation faster when eating just one food (Raynor & Epstein, 2001).
- **More snack food:** Eating a meal as a primary family activity has declined over the last three decades, but snacking has increased (Sturm, 2005b). Consumption of snack food such as chips, crackers, popcorn, and pretzels has tripled since the 1970s (Enns et al., 2002). Snack food is often high in calories and low in nutrients, and since it is often not satiating nor feels like a real meal, people may still consume regular meals on top of snacks, adding to extra calorie consumption.
- **Nutritious food is more expensive:** The prices of various food products have shifted over the last three decades. The cost of fresh fruits and vegetables has increased at a greater rate than the cost of soft drinks, snacks, and convenience food (Sturm, 2005b). This can skew food choices away from healthy foods to the cheaper, higher calorie food, particularly for families on limited incomes. For example, an apple (44 calories), a chocolate bar (200 calories) and a bag of potato chips (40 chips, 300 calories) all cost about $1, however, when people are on limited income, their choice may be based on what is more satiating and costs less.

When combined, impact of our food environment results in many North American adults and children routinely consuming an extra 200 to 300 calories a day. In the United States, for example, surveys show that the average caloric intake for men has increased from 2,450 calories a day to 2,618, and for women from 1,542 calories a day to 1,877 (Wright, Kennedy-Stephenson, Wang, McDowell, & Johnson, 2004). One pound is equal to 3,500 calories; an extra 200 calories a day translates to 73,000 extra calories a year, or a weight gain of over 20 pounds each year.

Changing Patterns of Physical Activity

The extra calories consumed over the last three decades might not have translated into excess weight if the levels of physical activity had not dramatically decreased at the same time. BC has the highest rate of physical activity in Canada yet even here daily physical activity has declined. Factors influencing reduced movement and physical activity include:

- **Supremacy of the automobile:** Society has increased its reliance on automobiles. Many families have two cars, and most errands and trips are done by car even if it is only a few blocks to the grocery store. In addition, instead of riding bikes or walking, most children are now driven to school. The majority of working adults drive all or part of the way to work. Finally, the increasing availability of "drive-through" services such as fast food, coffee, banking, or video drop-off means people are becoming even less active.
- **Neighbourhood design:** Neighbourhoods and cities are now designed around the automobile. Two

Spotlight on McCreary Centre Society Survey

Since 1992, the McCreary Centre Society, a small non-profit BC organization, has conducted three surveys on BC adolescents. Each survey consisted of a sample of 30,000 adolescents from grades 7 to 12. The 1998 Adolescent Health Survey looked specifically at weight issues and weight practices.

In each survey, BC youth were asked a wide variety of questions, including whether they have dinner with their family regularly, whether they eat breakfast in the morning, and how much time they spend watching television, playing video games, or engaging in physical activity. The surveys collected self-reported data on height and weight, which was then used to calculate body mass index (BMI). Youth in British Columbia have self-reported an increase in BMI over the last decade.

Over the three surveys, the self-reported results have shown the following:

- In 2003, 18 per cent of boys were overweight, compared with 15 per cent in 1992. Obesity in boys during the same time period went from 2 per cent to 5 per cent. For girls, the difference was relatively minor; 9 per cent of girls were overweight in 1992, compared to 10 per cent in 2003, while obesity rose from 1 per cent to 2 per cent during the same time period. As a result of the inherent weaknesses in self-reported data, these findings are likely undercounting the levels of overweight and obesity.
- For boys, the highest prevalence of overweight was found in the Northwest, Kootenay-Boundary, and Central Vancouver Island regions. The lowest prevalence of overweight was found in Richmond, the Okanagan, and North Vancouver Island. For obesity, the highest prevalence was found in the Northern Interior and Northwest, while the lowest was in the Kootenay-Boundary and North Shore/Coast Garibaldi regions.
- The Northwest region was also the highest for both overweight and obesity in girls, with East Kootenay and the Okanagan close behind. The lowest prevalence of overweight and obesity for girls was found in Vancouver, Richmond, and North Shore/Coast Garibaldi.
- Adolescents in BC compare favourably to the rest of Canada in being physically active. Among those in grades 7-12, 75 per cent exercise at least 3 days a week. A smaller number of obese youths say they exercise 3 or more days a week.
- As youths age, the level of physical activity declines. The vast majority of 13 and 14 year-olds were very active, but by the time the youth reach age 17, their activity levels dropped significantly. Fifty per cent of adolescent girls of that age did no exercise at all.
- The surveys showed that overweight or obese adolescents used the computer and watched television more than adolescents who were normal weight. About 26 per cent of obese adolescents watched more than 6 hours of television a week.
- The surveys asked questions of teens regarding attempts to lose or gain weight, and about methods to lose weight. A total of 60 per cent of overweight teens and 71 per cent of obese teens were currently trying to lose weight.
- Purging behaviour—vomiting as an attempt to lose weight—has declined since 1992, with just 7 per cent of girls and 3 per cent of boys reporting that they used vomiting at least once a month as a strategy for losing weight. In 1992, the numbers were 9 per cent of girls and 5 per cent of boys.
- Teens who were obese were far more likely to report that they had been discriminated against because of their appearance in the last year. They were also less likely to be involved in some group and social activities; this could contribute to an increase in sedentary pursuits among this group (McCreary Centre Society, 2003).

recent studies found that suburban sprawl is associated with higher BMIs and more chronic disease, while people who live in dense urban centres are more likely to walk (Sturm & Cohen, 2004; Ewing, Schmid, Killingsworth, Zlot, & Raudenbush, 2003). Lack of walking or bike paths, heavy traffic, and poor lighting can make walking or cycling unsafe or unpleasant.

- **Labour-saving devices:** Devices such as ride-on lawnmowers, snow blowers and leaf blowers, robotic vacuums, dishwashers, sound-activated lights, remote controls, irrigation systems, automatic garage door openers, and many others mean that even those small movements associated with household chores and daily living are no longer part of our lives.
- **Increasing "screen time":** Television, computer games, internet surfing, video games, video, and DVD make it possible for people to spend hours in front of a screen with no physical activity. The amount of time spent in front of a television or computer screen is directly related to increased BMI rates in both children and adults. The 2003 McCreary Centre Society Adolescent Health Survey found that overweight and obese adolescents watched six more hours of television per week than those of normal weight.
- **Changes to children's play:** Children are much less likely to be sent outdoors for unstructured play. This may be due to issues such as parents' safety concerns, more children being in after-school programs away from home, fewer stay-at-home parents, and more structured, organized play. As Dr. Mark Tremblay told the BC Forum on Childhood Obesity in March 2005, unorganized play is more strongly related to decreased obesity than participation in organized sport, in which children may only get 20 minutes of vigorous activity once or twice a week, rather than daily play outside (Childhood Obesity Foundation, 2005).
- **School activities:** While there have been encouraging initiatives in BC to integrate more physical activity into the daily life of the school through the innovative ActionSchools! BC Program, schools are still not being used to their full capacity to encourage physical activity. "Back-to-basics" movements and an increased focus on academics have diminished the perceived value of physical activity. By Grade 11, the majority of Canadian students no longer take physical education classes at school.
- **Adult exercise:** BC has the highest rate of physically active adults in Canada; nevertheless, the BC Nutrition Survey found that 61 per cent of adults do no strenuous activity and 36 per cent are sedentary, doing no moderate nor vigorous activity. The primary reason cited was lack of time due to work and family commitments. Research has found, however, that productivity increases when workers take time to exercise. Depression and anxiety decrease with regular exercise.

Eating Disorders

Although often overshadowed by the focus on obesity, eating disorders represent the other side of what is essentially the same fundamental problem: a disordered and unhealthy relationship to food. Obsessive dieting, anorexia, and bulimia, while different in their particular behaviours, share the common feature that the individuals who suffer from these disorders have lost the ability to eat a normal, healthy diet.

In North America, eating disorders are the third most common chronic health condition for females between the ages of 15 and 19. The disorders carry with them a high risk of serious health problems such as cardiac irregularities, electrolyte imbalances, weakened bones, permanently damaged dental enamel, and other complications, including death. Experts note that eating disorders usually begin as an attempt to control weight gain or because of a fear of becoming obese. Most eating disorders originate in early- to mid-adolescence, in individuals with a fragile sense of self who see body weight as the one area they think they can control (Johnston, 2004).

Anorexia and Bulimia

Anorexia involves restricting food to the point of extreme starvation and weight loss; it effects about 1 per cent of the population, predominantly females. Bulimia involves binging on food followed by purging by vomiting, laxative abuse, or diuretic misuse; it is estimated to effect about 6 per cent

of the population. Studies have shown that anxiety and depression are both common co-morbidities in anorexia and bulimia. Treatment with antidepressants and anti-anxiety medications has shown some effectiveness. However, the most promising treatment is cognitive behavioural therapy, which can address the underlying belief of self-worth being tied to appearance (Mehler, 2003).

Obsessive Dieting

The results from the 2003 McCreary Centre Society Adolescent Health Survey show that dieting behaviour is common among adolescent girls, even if they are of normal weight. More than 50 per cent of girls of normal weight in the McCreary study said they were on a diet. Dieting behaviour is even being found in younger and younger Canadians, even those of normal weight (McVey, Tweed, & Blackmore, 2004; Jones, Bennett, Olmstead, Lawson, & Rodin, 2001). One longitudinal study that involved almost 15,000 adolescent males and females found that not only was dieting ineffective to control weight but it actually led to weight gain, primarily as a result of restrictive eating following by bouts of binge eating (Field et al., 2003).

One of the concerns about focusing on obesity as a public health challenge is that it may contribute to an increase in eating disorders and an unhealthy focus on weight loss as a solution to obesity, rather than focusing on promoting healthy, active lifestyles that combine eating good food with regular physical activity.

Obesity is a symptom of profound changes in our society and the corresponding disruption to our relationship with food and movement. A focus on weight loss alone can promote unhealthy dieting behaviour in vulnerable individuals such as adolescent girls and women. One of the underlying factors in all eating disorders is the belief that physical appearance dictates one's value as a person (Mehler, 2003). This thinking is prominent in our media-saturated, celebrity-obsessed world, and we must be careful that in our zeal to reduce the health impacts of the obesity epidemic we do not fuel a continued obsession about appearance and increase eating disorders as a result.

Fostering Healthy Relationships to Food

This chapter illustrates the multitude of health problems that can arise through unhealthy patterns of eating. While weight loss will be beneficial for overweight/obese adults and for children who have gained far beyond healthy growth recommendations, the public health focus must be on promoting healthy eating in balance with regular physical activity, rather than focusing on weight loss. The most important aspect is that a person is fit and healthy for their particular body shape.

The goal of public health interventions in BC around food and exercise must be to create a society that fosters, for all British Columbians, a healthy relationship to food, as well as enabling everyone to experience the benefits of being fit and to feel the joy and fun that comes from regular physical activity.

Summary

- Non-communicable chronic diseases such as cancer, heart disease, diabetes, and respiratory disease now represent 80 per cent of the disease burden in North America. These diseases have inter-related risk factors, some that cannot be modified, such as age, genetics, or gender; and others that can be modified, like smoking, diet, and exercise. Poor food choice is a significant risk factor for chronic disease.
- In 2004, cancer was the leading cause of death in BC (8,401 deaths). Smoking remains the most common preventable cause of cancer, but diet is likely to be the second most common cause. In 1997 a landmark international report estimated that changes in diet could prevent 50 per cent of all breast cancers, 75 per cent of stomach cancer, and 75 per cent of colorectal cancer.
- Research has shown that one-third of all cancers could be avoided by eating more fruits and vegetables, whole grains, minimizing saturated fats and trans fats, maintaining a normal weight, and exercising regularly. Obesity itself is strongly related to a large number of cancers, with estimates that 14 per cent of all deaths from cancer in men and 20 per cent of deaths in women could be attributed to current patterns of obesity in North America.

Dial-A-Dietitian

Dial-A-Dietitian is an organization dedicated to providing "readily accessible quality nutrition information to the public and health information providers throughout British Columbia" (Dial-A – Dietitian Nutrition Information Society, 2004). Dial-A-Dietitian helps consumers by offering free nutritional information and raises consumer awareness of other related health services in British Columbia. Registered dietitians answer questions in 130 languages from the public, health educators, and the media by phone, mail or the web. This service complements the nutrition services provided by health authorities. In response to demand for information, the Allergy Nutrition Service opened to health professionals in November 2004, and the public in March 2005. Provincial health ministry guidelines, and a new tool called "Practice Based Evidence in Nutrition" (PEN) help to answer consumers' questions. PEN provides the dietitians answering questions with the most current healthy eating evidence-based recommendations, with links to supporting references, and resources.

In 2005/06, 20,509 calls were answered by the Dial-A-Dietitian service and there were more than 440,000 visits on the website. Areas of concern for callers were diabetes, cardiovascular conditions, infant feeding to manage or prevent allergies, and digestion (ulcer, diverticulosis, constipation, post surgery).

Dial a Dietitian works in partnership with the BC Nurseline to help British Columbians make informed decisions about their health. Dial a Dietitian hours of operation are Monday to Friday, 9 am to 5 pm. For more information, please contact Dial-A-Dietitian at 604-732-9191, 1-800-667-3438 or visit the website at www.dialadietitian.org.

- Cardiovascular disease was the second leading cause of death in BC in 2004 (6,697 deaths). Research has shown that the consumption of fruits and vegetables, fish, and omega-3 fatty acids and potassium, combined with regular physical activity and moderate alcohol consumption, is protective. Eating trans fats, deep fried foods, and baked goods, as well as being overweight, increases the risk of cardiovascular disease.
- An epidemic of Type 2 diabetes is now occurring in BC. In 2004, approximately 220,000 British Columbians were living with diabetes. The major risk factors are obesity, physical inactivity, and poor diet.
- In July 2005, Statistics Canada released a report confirming that obesity rates are at an all-time high in Canada. The results were obtained from the 2004 Canadian Community Health Survey (CCHS) that directly measured the heights and weights of 8,661 Canadian children aged 2 to 17 and 9,488 Canadian adults 18 and older.
- In 2004, 23 per cent of adult Canadians were obese, with BMIs of 30 or greater, compared to 14 per cent in 1978/1979. BC has the lowest rates of obesity in Canada; nevertheless 19 per cent of the adult population in BC are considered obese with BMIs over 30. British Columbia had more people who were overweight than all other provinces except Prince Edward Island. Both provinces had an overweight rate of 40 per cent. The overall rate of overweight adults in Canada was 36 per cent.
- In 1978/1979 only 3 per cent of children were obese, compared to 8 per cent in 2004; the percentage of overweight children rose from 12 per cent in 1978/1979 to 18 per cent in 2004. BC had the lowest obesity rates for children and adolescents at 7 per cent and Newfoundland had the highest at 17 per cent. Canada's overall rate was 8 per cent. Combining the rates, 26 per cent of BC children were overweight or obese, up from 15 per cent in 1978/1979.
- Obesity is highly complex and has elements of genetics, cultural behaviour, and psychology. Certain environments or social trends can also make it more likely for obesity to result. Some have identified such environments as the "obesogenic" environment, which is defined as an environment with a sum of influences that promotes obesity in a population (Swinburn et al., 1999).
- The obesogenic environment has brought changes in eating patterns and physical activity that underlie the obesity epidemic and it is through environmental modification that this epidemic can be reversed.
- Anorexia, bulimia, and obsessive dieting are flip sides to the same fundamental problem of obesity. About 7 per cent of individuals, usually adolescent girls, suffer from anorexia or bulimia.
- The goal of public health interventions around food and physical activity must be to create a society that helps children, adults, families, and communities to develop healthy relationships to food and to experience the energy and invigoration that comes from being physically fit.

Chapter 4:
Food Security Among British Columbians

What is Food Security?

As stated in earlier chapters, food is a determinant of health and the food that is available to people will determine their nutritional choices. This simple statement, in fact, is related to a complex food system that includes production, processing, distribution, availability, affordability, and consumption of food. All of these interrelated components can work to either support or interfere with available and affordable healthy food choices at the community level. Any barrier, break, or weakness along the food system can undermine the ability of the population to access safe, nutritious food, which can then undermine the health and wellness of the population.

> ***"Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy lifestyle."***
>
> *(Food and Agriculture Organization of the United Nations [FAO], 1996)*

A healthy food system is required to support healthy food choices. Some special groups in our population may have additional challenges accessing healthy foods. For those on low-income, affordability and accessibility to healthy food can be challenging. For immigrants, religious groups, or Aboriginal population, there may be additional challenges in accessing foods that are culturally acceptable. For those living in rural and remote communities, the above issues are compounded by limited or expensive transportation of healthy foods to their rural communities, as well as transportation barriers within the community to local food sources. It is important to note that those involved in production, processing, and distribution of foods should be able to make a living wage while using safe farming practices that do not compromise the air, land, and water for now and for future generations (Hamm & Bellows, 2003).

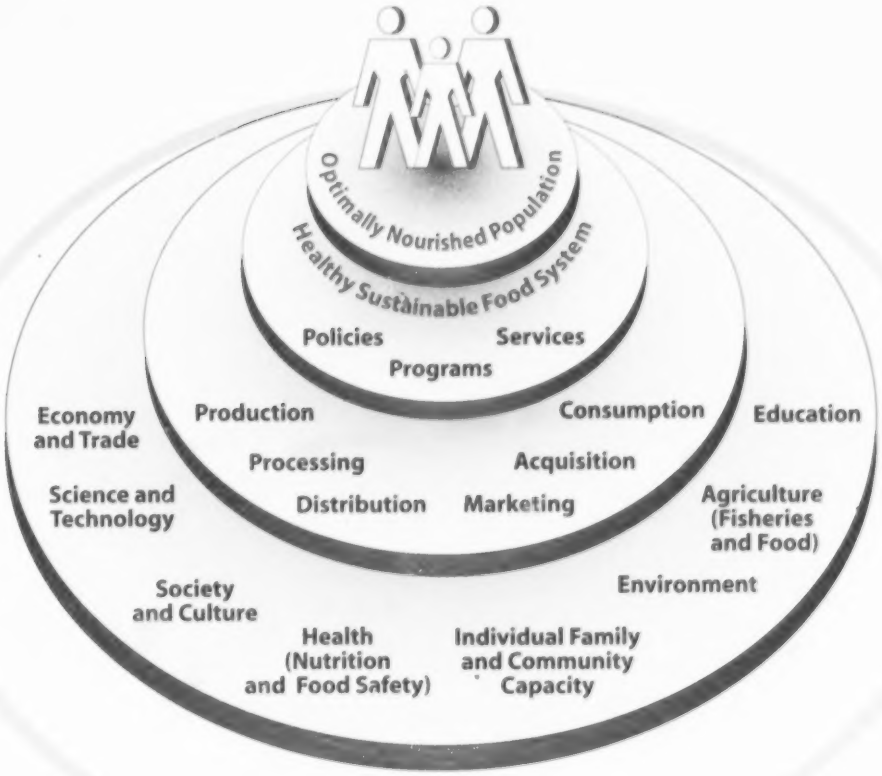
> ***Food security is defined by a situation in which all community residents can obtain a safe, culturally acceptable, nutritionally adequate diet through a sustainable food system that maximizes self-reliance and social justice."***
>
> *(Hamm and Bellows, 2003)*

Food scarcity and deprivation represents a significant and growing problem for the poor in many western nations, including Canada. If individuals lack the physical or economic access to the foods they need in order to live productive, healthy, and active lives, they are considered to be food-insecure. People may be food-insecure because they live in geographically isolated communities with limited availability of nutritionally adequate and safe foods, or they may lack sufficient funds to purchase foods that constitute a healthy diet. Individuals or families who are anxious about their ability to acquire personally acceptable food through normal food channels, without having to rely on emergency food programs like food banks, are also considered to be food-insecure (Davis & Tarasuk, 1994; Travers, 1996).

Food insecurity re-emerged as a concern in Canada during the 1980s and 1990s, as a result of recessions and the erosion

Figure 4.1

The Food System



Any food system is an economic and political creation. The interdependence of economic and political elements of the food system is illustrated in Figure 4.1. An optimally nourished population depends on a healthy sustainable food system that is influenced by the political process of policies, programs, and services. The influence of this process is present on economic factors such as production, processing, distribution, marketing, acquisition and consumption of food. These factors will then shape elements such as economy and trade, science and technology, society and culture, health, individual family and community capacity, environment, agriculture, and education.

Adapted from: *Making the Connection – Food Security and Public Health*, The Food Security Standing Committee of the Community Nutritionists Council of BC, March 2004.

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of the social safety net through government spending cuts aimed at debt reduction (Tarasuk & Davis, 1996). The number of food banks increased significantly during these decades, and children's school-based feeding programs were expanded (McIntyre, 2003). In 2000/2001, the number of Canadians considered to be living in food-insecure households was almost 15 per cent—an estimated 3.7 million people (Ledrou & Gervais, 2005).

Some types of Canadian households—such as single parents, recipients of social assistance, and the Aboriginal population living off-reserve—are more likely to experience food insecurity. About 31 per cent of the Aboriginal population living off-reserve report food insecurity, more than double the rate for the non-Aboriginal population (Ledrou & Gervais, 2005). Chapter 6 of this report will discuss in detail the relationship between food and health as it relates to BC's Aboriginal population.

Food Insecurity in British Columbia

The level of food insecurity in BC is above the national average and is cause for concern. In 2001, about 17 per cent of BC's population could not afford the quality or variety of food they wanted, worried about having enough to eat, or had not had enough to eat at some time in the previous 12 months. The national average was 15 per cent in the same year. BC's lower and lower-middle income households were most likely to have food insecurity, with 30 per cent of those households reporting at least one instance of not having had enough food to eat in the previous year (Ledrou & Gervais, 2005).

Some examples of the higher costs of living and reduced purchasing power in BC that may be behind the higher rates of food insecurity include the following:

- The cost of housing has risen in BC's major urban centres, which makes it more difficult to obtain affordable housing. The waiting list in BC rose from 2001 to 2003, after declining from 1996's high of 11,250 applicants. In 2001, about 10,000 people were on the list for social housing; by 2003, that number had risen to 10,450. Most of the applicants were in the Greater Vancouver region, and the majority of those were families (Irwin, 2004).
- Based on 2004 income assistance payments, BC's amount of assistance for two parents with two children was the second lowest in the country (National Council of Welfare, 2005). A single parent in BC with one child would only have a total annual income of about $13,778. The incomes of BC families (with children) receiving social assistance were approximately 17 to 18 per cent lower in 2004 than they were in 1994 (First Call: BC Child and Youth Advocacy Coalition [First Call], 2005).
- More people are homeless and lack access to even basic cooking and food storage facilities. In Greater Vancouver, the number of homeless people increased by more than 100 per cent from 2002 to 2005, to more than 2,100 people. An additional 126,000 people in about 56,000 Greater Vancouver households are at risk of becoming homeless (Greater Vancouver Regional Steering Committee on Homelessness, 2005). In Victoria, where the homeless were counted for the first time in 2005, about 700 people were dependent on emergency shelter or lived on the streets, and a majority of those reported health problems (Victoria Cool Aid Society, 2005).
- The provincial minimum wage of $8 an hour[1] means that an individual working 40 hours a week for 52 weeks in a year earns $16,640, considerably below the federal government's Low Income Cut-Off (LICO) (Ministry of Labour and Citizens' Services, 2003).

Low-Income Cut-Offs

Established by Statistics Canada, Low Income Cut-Offs (LICOs) are a measure of income below which a family would be substantially worse-off compared to the average population. Such families would likely spend a larger proportion of their

Rates of Food Insecurity in Canada

In 2000/2001, Statistics Canada posed questions about food access and consumption on the Canadian Community Health Survey. Respondents were considered to be food-insecure if, in the previous 12 months, due to a lack of income, they, or someone in their household, met at least one of the following criteria:

- worried that there would not be enough to eat;
- did not eat the variety or quality of food that they wanted, or;
- did not have enough to eat.

Using this definition, 15 per cent of the population, aged 12 or older, had been food-insecure. Over 40 per cent of people in low- or lower-middle-income households reported food insecurity, and almost 25 per cent of middle-income households did as well.

Younger people were more likely to report food insecurity. About 18 per cent of people aged 12 to 44 had experienced some component of food insecurity. Rates were also high among Aboriginal people living off-reserve, at 31 per cent.

It should be noted that the survey does not cover the homeless or Aboriginal people living on-reserve, which may mean that the prevalence of food insecurity in Canada is higher than reported (Ledrou & Gervais, 2005).

[1]This applies to people who have worked a total of 900 hours with one or more employers. If the person has no paid work experience or had less than 900 hours prior to November 15, 2001, their minimum wage would be $6 per hour (Ministry of Labour and Citizens' Services, 2003).

Regional Variations in Food Security in BC

Some areas of BC are more likely to have food-insecure households than others. People living in upper Vancouver Island, the Central Coast, the Cariboo, East Kootenays, and the Fraser Valley are more likely to have experienced food insecurity. More than 14 per cent of the people surveyed in these regions reported "sometimes" or "often" worrying that their household would not have enough to eat due to lack of money. In Vancouver and the Capital Regional District, more than 11 per cent of people surveyed said they had experienced food insecurity at some point in the previous year. Residents of the North Shore were the least likely to have been food insufficient (Statistics Canada, 2001).

income (approximately 20 per cent more) on food, shelter, and other necessities (Statistics Canada, 2006).

LICOs were first introduced in 1968 and were based on 1961 Census income data and 1959 family expenditure patterns. Subsequent LICOs were revised based on national family expenditure data from 1969 to 1992. The latest LICO figures were calculated for seven categories of family size from one person to seven or more in a family for rural areas and urban centres (Statistics Canada, 2006 & 2005b).

Statistics Canada has clearly maintained that LICOs are not a measure of poverty and are intended to only identify those who are substantially worse-off compared to the average population. However, in the absence of a nationally recognized and accepted measure of poverty, LICOs have made it possible to study important trends and changing composition of lower-income populations. For example, two or three decades ago, the elderly population were the largest group in the "low-income" category, while more recently, lone-parent families—particularly those headed by women—occupy the larger proportion (Figure 4.2) (Fellegi, 1997; Statistics Canada, 2006 & 2005b).

The Impact of Food Insecurity on Vulnerable Populations

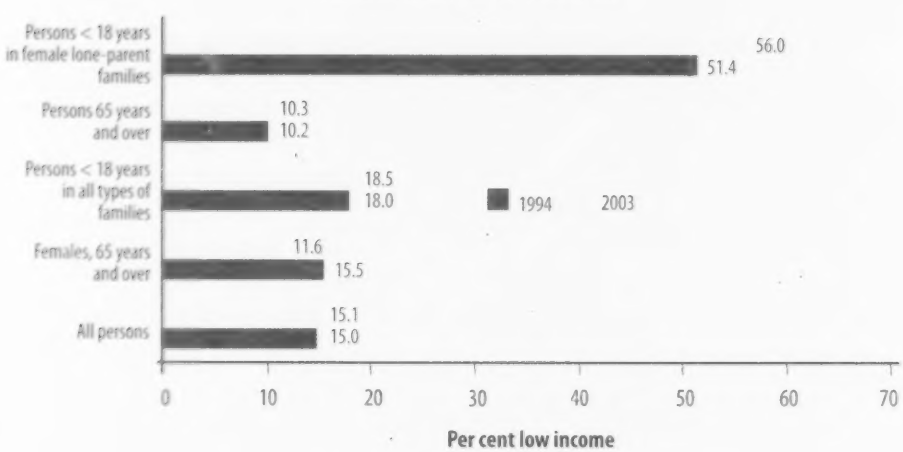
Children

Adequate nutrition in childhood supports healthy growth and development and increases opportunities for a long and productive life. The disproportionate number of children living in hungry households is a matter of grave concern. Across Canada, children are, in general, the age group most likely to live in hungry households (Che & Chen, 2001).

Figure 4.2

In 2003, 56 per cent of those in the low income after tax group in BC were individuals under 18 years of age living in female lone-parent families.

Prevalence of Low Income After Tax (Selected Groups, BC, 1994 and 2003)



Source: Statistics Canada. (2003). *Income in Canada, 2003* [Catalogue No. 75-202-XIE; CANSIM Table 202 - 0802]. Ottawa, ON: Statistics Canada.

Studies show that children living in single parent households are more likely to experience food insecurity. The 2000/2001 Canadian Community Health Survey found that one-third of lone female parents reported food insecurity (Ledrou & Gervais, 2005). Significantly, more than one-half of the children in Canada who experienced hunger in 1996 lived in households receiving a main income from employment and not from social assistance (McIntyre, Walsh, & Connor, 2001).

In BC, child poverty[2] diminished slightly in the late 1990s, and then rose from 2002 to 2005.

- About 201,000 BC children lived in poverty in 2003 (First Call, 2005).
- Overall, the poverty rate for BC children in two-parent families was 15 per cent in 2003, while the rate for children living in single-parent families was 65 per cent (First Call, 2005).
- About 10 per cent of children living in poverty had at least one parent working in a year-round, full-time job. Some do not receive enough work hours to earn a sufficient living, while others are in minimum-wage jobs that do not allow them to climb above Statistics Canada's Low Income Cut-Offs (First Call, 2005).
- Almost one out of every four BC children live in poverty, based on Statistics Canada's Low Income Cut-Offs (First Call, 2005).

For BC's low-income households, and individuals or families receiving income assistance, putting healthy food on the table is a daunting task. Food expenses, unlike housing costs, are one of the more elastic components of household budgets, and can be compressed to accommodate other urgent expenses such as transportation, utilities, and personal hygiene items. Juggling household

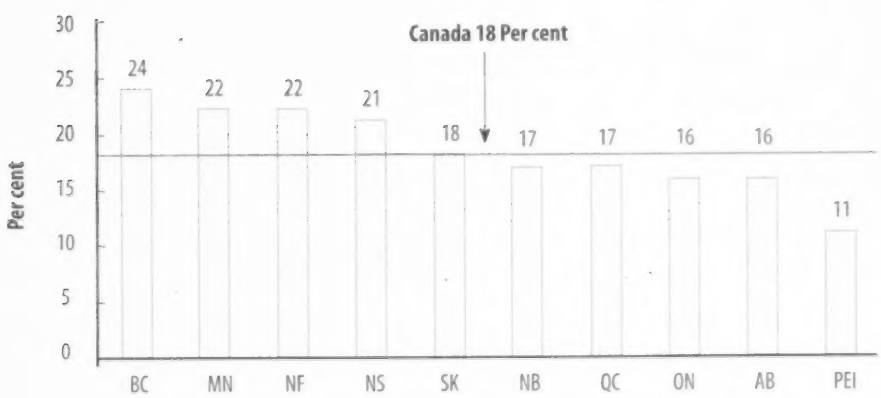
Market Basket Measure

Introduced by the federal government in 2003, this measure tabulates what it costs a family of four, with two adults and two children, to purchase a basket of basic goods and services in 48 different parts of the country. People are considered to be relatively impoverished when their income—after taxes, child support, payroll deductions, and out-of-pocket medical expenses—falls short of covering the cost of the prescribed "basket" of goods. The survey found that one in five British Columbians does not have enough money to afford items that are considered to be the components of a reasonable standard of living in Canada. These items include basic necessities such as nutritious food, shelter, clothing, and transportation, as well as sundries such as stamps and video rentals (Human Resource Development Canada, 2003).

[2] *The measure of poverty is based on Statistics Canada's Low Income Cut-Offs.*

Figure 4.3

Child Poverty Rates,* Canada and Provinces, 2003



* Poverty rates are based on Low-Income Cut-Offs for 2003 from Statistics Canada

Source: First Call, BC Child and Youth Advocacy Coalition. (2005, November). *3C campaign 2000: Fact sheets.*

In 2003, BC had the highest rate of child poverty in Canada at 24 per cent (First Call, 2005). The overall national rate was 18 per cent. (Figure 4.3)

What is in the National Nutritious Food Basket?

To determine the cost of buying nutritious food in Canada, Health Canada uses a standardized method called the National Nutritious Food Basket. The basket, also referred to as the healthy food basket, is consistent with the food purchases of ordinary Canadians, and meets basic nutrient and caloric requirements. The food in the basket requires preparation, necessitating time and cooking skills, and does not account for any food purchases at food service outlets.

The National Nutritious Food Basket consists of 66 foods that reflect nutrient requirements and food purchase patterns. It includes products from the four food groups in *Canada's Food Guide to Healthy Eating*, including:

- dairy products such as 2% milk, fruit-flavoured yogurt, and cheddar cheese;
- protein sources such as stewing beef, chicken legs, cooked ham, frozen fish fillets, dried navy beans, and peanut butter;
- grains like white and whole wheat bread, dry spaghetti, long grain white rice, cooking oatmeal, and all-purpose flour;
- fruit and vegetables such as oranges, canned tomatoes, apples, romaine lettuce, frozen mixed vegetables, cabbage, and carrots;
- condiments like butter, margarine, white sugar, and jam.

This tool can be used to compare the relative cost of food in Canadian communities (Dietitians of Canada, 2004).

expenses to afford food is a constant and stressful battle in low-income households (Vozoris, Davis, & Tarasuk, 2002; McIntyre, 2003).

Seniors

Seniors over the age of 65 who are on fixed incomes are another vulnerable population in BC. In 2004, 13.7 per cent of the BC population was over the age of 65, and this per centage will increase to 23.5 per cent by 2031.[3]

As noted in the 2002 Provincial Health Officer's report, *The Health and Well-being of People in British Columbia* (PHO, 2003), the majority of seniors in BC are doing well. Nationally 70 per cent of seniors are homeowners, with 64 per cent being mortgage-free. While most BC seniors are healthy and relatively well-off, some seniors are isolated and alone, with insufficient income or social support. These are most often elderly women who have outlived their partner. In 2002, 10.2 per cent of BC's female seniors were living below the LICO levels set by Statistics Canada, meaning they spent a larger proportion of their income on food, shelter, and other necessities (PHO, 2003).

Elderly people who lack sufficient food are more susceptible to depression, reductions in taste and smell sensations, poor health, and poor dentition (Wolfe, Olson, Kendall, & Frongillo, 1998). Inadequate diets among the elderly may also contribute to or worsen disease, increase disability, spur the advance of age-related degenerative diseases, decrease resistance to infection, and extend hospital stays (Wolfe, et al., 1998).

Pregnant Women

Women in food-insecure households risk having an inadequate intake of essential nutrients, such as folate, found in leafy green vegetables and fresh fruit. For pregnant women, this can put their unborn child at higher risk of neural tube defects, and can compromise nutrition during breastfeeding.

Inadequate nutrition during pregnancy can lead to low birth weight infants, which significantly increases the neonatal health care costs to meet the immediate health needs of the child, and puts them at risk of permanent disability such as learning disabilities, respiratory problems, poor eyesight, and other long-term physical disabilities.

How Much Does Healthy Food Cost?

The cost of food in BC varies from neighbourhood to neighbourhood, and from community to community. People living in rural and remote communities, as well as lower income communities, can expect to pay more for food than those living in urban areas with a wide range of grocery stores easily accessible by foot, bicycle, public transportation, or private vehicle.

Notably, food prices in BC rose 38 per cent from 1989 to 2003 (Dietitians of Canada, 2003), a time period also characterized by rising housing costs, lower real social assistance rates, and reductions in federal employment insurance benefits.

Every year, registered dietitians working in public health for regional health

[3] *Population estimates (1986-2004) and projections (2005-2031) by BC STATS (P.E.O.P.L.E.30), Service BC, BC Ministry of Labour and Citizens' Services.*

authorities, price the nutritious food basket to determine the monthly cost of purchasing the basket for a BC family of four (two parents and two children), by surveying grocery stores across the province. An economies of scale factor for a family size smaller or larger than four is then applied to determine food costs for a variety of age and gender groups. This information is used to prepare *The Cost of Eating in BC* report by the Dietitians of Canada, BC Region, and the Community Nutritionists Council of BC. In 2005, based on a study of 109 grocery stores across 5 regional health authorities, they found that the monthly cost of feeding an average BC family of four was $654.46, which was 3.5 per cent higher than in 2004 (Dietitians of Canada, 2005b).

Published annually since 2000, *The Cost of Eating in BC* reports have all concluded that BC residents living on low incomes cannot afford a healthy diet after paying for average shelter expenses. For example, the report notes:

- A single woman living alone on income assistance would not be able to afford reasonable shelter or healthy food. She would receive a total of $510 per month on assistance. Shelter (a bachelor apartment at the 25th percentile for rent) alone would cost about $580 per month. After paying rent, she would not be able to afford any food, or any other necessities (Dietitians of Canada, 2005b).

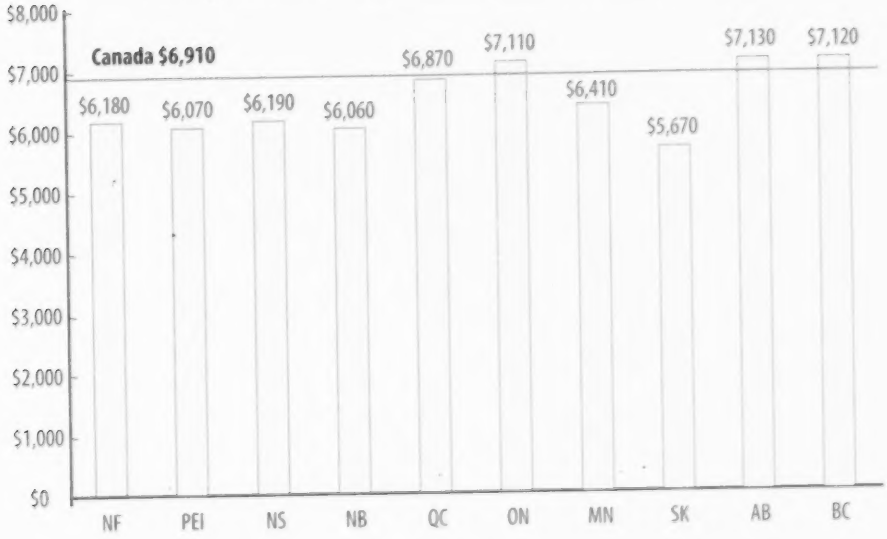
Nourished Moms, Healthy Babes

BC's Pregnancy Outreach Program (POP) is a nutrition program that provides prenatal and postnatal services and resources throughout the province to support women who are at risk of having a low birth weight baby.

POPs began as a way to reach out to women who do not access typical prenatal services. There are now over 46 programs in BC (Burglehaus, 2004). The programs have been beneficial in reducing the chance of mothers having a low birth weight baby. In 2004, approximately 6,500 women were seen through the POPs in BC (Ministry of Health, 2005a).

Figure 4.4

Average Household Food Expenditures, Canada and Provinces, 2004



Source: Statistics Canada. (2005c). Survey of household spending [CANSIM Table 203-0001].

Overall, BC residents spend more for food than all other provinces except Alberta. The average food expenditure in Canada in the same year was $6,910 (Figure 4.4).

2005 Monthly Cost of Eating in BC

To determine the cost of healthy eating in BC, in June 2005, registered dietitians across the province priced a food basket using Health Canada's National Nutritious Food Basket measure, in 109 grocery stores in all health regions. The food basket is neither an ideal diet nor the least expensive diet but it is consistent with the food purchases of ordinary Canadian households, based on a family of four. The food costs do not include take-out or restaurant eating and do not consider the potential availability of emergency food programs. The economies of scale factor for a family size smaller or larger than four was applied to determine total food costs. The food costing tool was used in this report to determine the affordability of food for a low-income family and various family scenarios living on income assistance compared to the average Canadian family. This has been reported as an appropriate use of this costing tool. The proportion of disposable income (take home earnings plus child and family benefits) spent on food for the low-income family, including the family on assistance, was compared to the average family. The money available after shelter and provincial health care plan costs would need to be used to purchase food and all other necessities including transportation, clothing, child care, personal hygiene items, laundry and cleaning supplies, school supplies and fees, and medical, dental, and optical costs. The potential costs of these other necessities was determined using 2005 costing data from the Social Planning and Research Council of BC (SPARC).

Source: Dietitians of Canada, 2005b.

Table 4.1

2005 Monthly Cost Of Eating in BC
(based on living in a family of four)

Age/Gender Groups	Total Monthly Cost
Family Of Four	$654.46
Family Of Three	$477.34
Child	
1 Year	$74.62
2–3 Years	$80.43
4–6 Years	$107.86
Boy	
7–9 Years	$130.48
10–12 Years	$160.20
13–15 Years	$186.68
16–18 Years	$218.53
Girl	
7–9 Years	$123.80
10–12 Years	$145.55
13–15 Years	$156.13
16–18 Years	$149.24
Man	
19–24 Years	$207.64
25–49 Years	$199.85
50–74 Years	$179.53
75+ Years	$161.67
Woman	
19–24 Years	$152.49
25–49 Years	$144.13
50–74 Years	$140.96
75+ Years	$136.85
Pregnancy and Breastfeeding	
13–15 Trimester 1	$169.35
13–15 Trimester 2	$178.79
13–15 Trimester 3	$178.79
13–15 Breastfeeding	$185.12
16–18 Trimester 1	$169.30
16–18 Trimester 2	$181.74
16–18 Trimester 3	$181.74
16–18 Breastfeeding	$187.20
19–24 Trimester 1	$165.36
19–24 Trimester 2	$176.97
19–24 Trimester 3	$176.97
19–24 Breastfeeding	$181.87
25–49 Trimester 1	$157.86
25–49 Trimester 2	$167.79
25–49 Trimester 3	$167.79
25–49 Breastfeeding	$171.77

- A single-parent family with two children receiving income assistance plus their Child and Family Tax Benefit would be $26 short after paying for shelter and food. They would have nothing left for all other expenses, including transportation, clothing, laundry supplies, and other items (Dietitians of Canada, 2005b);
- Low-income families in BC also struggle to balance food costs with other necessary expenditures. A low-income family of four, with one earner in a full time job at $11/hour, has a disposable monthly income of $2,218, including child and family benefits. This family has $587 remaining, after average shelter and food expenses, to pay for all other costs of daily living, including clothing, transportation, toiletries, school supplies, etc. In comparison, a BC family of four with an average income (disposable monthly income of $4,307) still has $2,333 to spend each month after housing and food costs. While the average-income family of four would spend about 15 per cent of their income on the food basket, the low-income family would need to spend about 30 per cent of their income to buy the same food basket. A family of four on income assistance would need to spend 44 per cent of their income on the food basket (Dietitians of Canada, 2005b).
- A single, pregnant woman living alone on income assistance in BC would most likely be unable to feed herself adequately or nourish her developing baby. She would receive $555 a month in assistance, which would not cover the average cost of a bachelor apartment at $580 a month (Dietitians of Canada, 2005b).

The Link Between Hungry Households and Poor Health

Earlier in this report, the impact that unhealthy diets have on health was outlined. Low-income British Columbians face challenges in affording healthy foods and that may well contribute to their higher rates of chronic diseases and nutritional problems, including micronutrient deficiency (Health Canada, 1996).

Studies consistently show that people in hungry households have poorer nutrition than those in food-secure homes. The daily diet of low-income households generally does not include many fruits, vegetables, or whole grains. It is also lower in essential nutrients than typical diets in food-secure households, including calcium, iron, magnesium, folate, and vitamin C (James, Nelson, Ralph, & Leather, 1997). Canadian women in food-insecure households eat far fewer fruits and vegetables and consume far less than the recommended dietary allowance of vitamin C, potassium, and other key vitamins and minerals, compared to women in food-secure households. The frequency of fruit and vegetable consumption among these women declined significantly as food insecurity status increased (Statistics Canada, 2001).

Individuals in food-insecure households in Canada are more likely to report ailments such as heart disease, diabetes, and high blood pressure (Vozoris & Tarasuk, 2003). Once a chronic health problem appears, it is challenging for those on low incomes to follow dietary recommendations for their illness, such as a low-sodium diet for high blood pressure or a high-fibre, low-fat, low-added sugar diet for diabetes. Such special diets often cost more than the basic diet. For example, a diabetic diet costs about

Food Insecurity and Cigarettes

Food insecurity contributes to costly health problems in many ways. Lower income groups, for instance, exhibit higher smoking rates. Cigarette smoking among lower income women is reported to reduce stress, and also act as an appetite suppressant. One study showed that primary caregivers in "hungry households" were 1.7 times more likely to smoke than other primary caregivers (McIntyre, Connor, & Warren, 2000).

Children Come First

Research shows that parents in food-insecure households will deprive themselves of nutritious food in order to feed their children. One study of food-insecure women in Atlantic Canada found that mothers compromised their own nutritional intake to ensure their children had optimal nourishment. The mothers' diets lacked adequate intakes of most nutrients examined. Nutrients in their children's diets appeared to be sufficient, with the notable exception of folate and zinc (McIntyre et al., 2003).

Relative Cost of Calories

Healthy, nutritious food costs more per calorie than unhealthy junk food. The following items all cost about $1 in BC:

- One apple – 44 calories.
- One chocolate bar – 200 calories.
- One bag of potato chips (40 chips) – 300 calories.

When people are poor, they will often choose to eat cheaper, unhealthy food because it gives them a higher caloric intake. Diets replete with added sugars and fats are far more affordable than healthy diets comprised of lean meats, whole grains, and fresh vegetables and fruits (Drewnowski & Darmon, 2005).

$60 more per month than the 2005 BC basic food basket (Anderson, McKellar, & Price, 2006).

Children in hungry households in Canada are reported to have significantly poorer health than other children (McIntyre, Connor, & Warren, 1998). Almost 30 per cent of children in food-insufficient households suffer from asthma, compared with 13.5 per cent of children in food-secure households (McIntyre et al., 2001). Insufficient nutrition during early childhood can cause permanent cognitive damage, affecting a child's ability to learn and function (Community Nutritionists Council of BC, 2004). American studies have documented chronic minor health problems among children from food-insecure households that include fatigue, irritability, dizziness, recurring headaches, frequent colds and infections, and difficulty concentrating (McIntyre et al., 2001). In adolescents, food insufficiency has been linked to low-level depression and suicide symptoms (Alaimo, Olson, & Frongillo, 2002).

Paradoxically, as food insecurity increases, so does the tendency for women to be overweight or obese, increasing the potential for obesity-related chronic diseases such as diabetes (Townsend, Peerson, Love, Achterberg, & Murphy, 2001; Drewnowki & Specter, 2004). A study of obese Canadian children found that 6.4 per cent of children in the wealthiest quarter of the population were obese, compared with 12.8 per cent in the poorest quarter (Community Nutritionists Council of BC, 2004).

Food Distribution, Storage, and Preparation: Limited Choices for Low-Income People

Aside from cost, other factors also limit and prevent low-income British Columbians from accessing healthy foods. In order to have food security, BC residents must also have ready physical access to quality grocery stores and food sources, kitchens to cook in, and places to safely store food. Low-income individuals often have fewer choices to address these factors.

For those on low incomes, lack of easy access to grocery stores can pose an additional obstacle to the attainment of food security. Vulnerable people may live in areas that are not well served by quality food outlets. The range of food available in stores accessible to low-income families and individuals determines what type of food is bought, which, in turn, influences health-related behaviours (Toronto Food Policy Council, 1996).

A comparison of food retail outlets in Toronto's two poorest neighbourhoods indicates that, the poorer the neighbourhood, the more convenience outlets it has and the fewer full-service grocery stores. Twenty-four-hour convenience stores stock items like chips, pop, packaged baked goods, candy, chocolate bars, magazines, cigarettes, lottery tickets, and higher-priced milk products. There are few (if any) fresh fruit and vegetables. In Toronto's Regent-Moss Park neighbourhood, 57 per cent of families and single persons live below the low-income cut-off. In Toronto's South Parkdale neighbourhood, one-third of families and 43 per cent of single persons live below the low-income cutoff line. In Regent-Moss Park, the poorer of the two neighbourhoods, 62 per cent of all food stores are convenience outlets. In South Parkdale, 33 per cent are convenience stores (Toronto Food Policy Council, 1996). No similar data exists for BC but this would be an important area of future research.

Studies in the United States show that the poorer sections of many American cities have been abandoned altogether by food retail outlets. Studies from the United States and the United Kingdom show that people without automobiles pay more in money, time, and energy for access to quality food stores (Toronto Food Policy Council, 1996).

For seniors and the disabled, limited access to shopping can pose a major barrier to obtaining food. Poor mobility can make nutritious food inaccessible even to those who can afford it. Functional impairments can also have an impact on the ability to prepare and consume food.

People living in single rooms or other basic accommodation also face barriers to the nutritious and economical preparation of foods. They may only have access to a hot plate, lack a refrigerator, and have limited room for storage of bulk food that is often available at lower prices. The homeless have no access to cooking or food storage facilities.

Northern aboriginal communities also face unique challenges in attaining food security. Food sold in northern aboriginal communities is more expensive, frequently poor in quality, and lower in nutritional value than traditional foods grown

locally (Dietitians of Canada, 2005a). Low incomes are a major contributing factor to the prevalence of food insecurity in these communities, but so are quality problems associated with inappropriate shipping, handling, and home preparation of commercial foods. Shorter growing seasons in the north pose a challenge for local growers. Chapter 6 provides a detailed explanation of diet and health among BC's Aboriginal population.

Measures to Reduce the Impact of Poverty

Since it is now recognized that the main solution to individual and household food insecurity is to eliminate poverty, the final section of this chapter looks at the various actions by the federal and provincial governments, and by communities, schools, and municipalities to address the impact of poverty on food security.

Federal and Provincial Programs

In operation for the last three decades, unemployment insurance (now called Employment Insurance) is a fund to assist people who are temporarily jobless. Following the restructuring of the fund in 1995, eligibility for benefits was restricted, levels of benefits were lowered, and shorter benefit periods were instituted, which resulted in fewer people receiving funds and greater economic hardship. Low-income families and individuals do receive a quarterly Goods and Services Tax credit from the federal government.

Since 1998, low-income families with children have been eligible for the federal government's monthly National Child Benefit (NCB), a supplement to the Canada Child Tax Benefit intended to help relieve financial hardship for families with incomes of $35,000 or less (National Council of Welfare, 2005). Provinces and territories were allowed to adjust social assistance or child benefit payments by an amount equivalent to the NCB supplement. These adjustments would allow provinces and territories to reinvest in benefits and services for low-income families with children (National Child Benefit, n.d.).

In BC, the BC Family Bonus was reduced by the full value of the federal supplement, meaning that families on social assistance were no further ahead. The National Council of Welfare advocated an immediate end to these types of "clawbacks" by BC and other provinces (National Council of Welfare, 2005). From the beginning, Newfoundland and Labrador and New Brunswick did not reduce social assistance payments. More recently, the governments of Nova Scotia, Quebec, Manitoba, Alberta, and Ontario decided to limit their clawback (National Council of Welfare, 2005).

The BC government provides social assistance for those who have no other source of income but this assistance has not kept pace with inflation and falls short of covering the cost of shelter and food.

In BC, the Provincial Health Officer has stated that evidence suggests that government programs that reduce social inequities, and mitigate the impacts of low socio-economic status, will have more impact on the health of the population than simply providing more and more health services to treat preventable disease (PHO, 2005). Placing a priority on ensuring that low-income families can afford to purchase nutritious food would be an important step towards reducing food insecurity in BC and fostering a healthier population.

Core Functions in Public Health

For the last few years, BC's Ministry of Health has been involved in an extensive process to define a set of core functions in public health—key preventive and protective services that have good evidence of effectiveness and whose impact can be measured.

Through extensive consultations and research, a core functions framework has been established and 21 core programs, including food security have been identified. Now, in the second phase, evidence papers for each program are being written, model core program papers and performance measures are being developed, and an extensive website is being created by the ministry. The third phase will be a three-year, rolling process of implementation that will continue (7 programs at a time) until 2009/2010.

For each core program, health authorities will develop program components and measures, identify their gaps, and develop performance improvement plans and targets. In the third year, it is hoped that they will be able to report on their progress in a system that is transparent and accountable to the public. For more information on Core Functions in Public Health, please refer to the Ministry of Health website at http://www.health.gov.bc.ca/prevent/.

Community Food Action Initiative

The Community Food Action Initiative is a joint project between the Ministry of Health, the BC Public Health Alliance on Food Security, and the Provincial Health Services Authority. The objectives of this initiative are to:

- Increase awareness of food security.
- Increase access to local, healthy foods.
- Increase food knowledge and skills.
- Increase community capacity to address local food security.
- Increase development and use of policy that supports community food security.

This initiative is a part of the healthy eating component of ActNow BC and will provide support for the planning and implementation of community, regional, and provincial initiatives for increased access to safe, culturally acceptable, nutritionally adequate diets through a sustainable food system.

A number of agreed-upon principles have been applied to the Community Food Action Initiative which include: respect for autonomy, dignity, and diversity; universal access, targeted focus; fairness and openness; flexibility; comprehensiveness; evidence-based; and accountability.

The Cooking and Skill Building Project

The Ministry of Employment and Income Assistance is working collaboratively with the Ministry of Health to identify options for a $250,000 fund made available for fiscal year 2006/2007 by the Ministry of Employment and Income Assistance. The money will be used to support activities to increase food security in local communities related to cooking and skill building for low-income families.

More information about the Community Food Action Initiative will be available on the ActNow BC website (BC Public Health Alliance on Food Security, 2005).

As an example, the BC government introduced the School Meal Program in 1991 to provide hungry children with the nutrition they need to be able to concentrate and learn at school. The costs of this program were shared by school districts, community agencies, and the provincial government, and by 1996, meals were offered at 300 schools in BC. While this program is a great help, it appears it may not be enough. The organization Breakfast for Learning reports that at least 35 new school meal programs are needed in BC and 67 existing programs should be expanded (Directorate of Agencies for School Health, BC, 2002).

Food Security: Public Health Core Function

Over the past decade, food insecurity has become a seminal concern, not just in BC, but across Canada and around the world. In 1996 the United Nations' Food and Agriculture Organization organized a World Food Summit that launched a concerted campaign to achieve global food security, bringing together governments, international organizations, and all sectors of society. The right of all people to have access to safe and nutritious food was affirmed by 187 countries at the summit, including Canada.

In BC, the importance of food security to public health was recognized in 2005, when food security was designated a core public health function. Core functions are a set of public health services and activities that have the following criteria:

- A primary or early secondary prevention intervention.
- Reasonable scientific or "best practice" evidence exists for both its effectiveness and cost-effectiveness.
- Performance indicators exist or can be developed that can measure its impact (Hancock, T., personal communication).

By establishing food security as a public health core function, it is recognized that access to sufficient, safe, and nutritious food is a core need that BC's health authorities, the provincial government, and society itself must address. Better nutrition in turn will help to reduce the overall burden of acute and chronic disease and disability and improve the health and wellness of the people in British Columbia.

Community Measures

The community response to food insecurity includes food banks, community gardens, community kitchens, and other programs such as good food boxes. Food banks are not a solution to food insecurity and were meant to be temporary emergency measures. Capacity-building initiatives such as community gardens, farmers' markets, and fruit-picking projects all help to improve access to healthy food, as well as to support local growers and producers. Community food policy councils have been key in many communities in supporting and advancing such capacity-building initiatives.

Food Banks

The first food bank in Canada opened in Edmonton in 1981. Like subsequent food banks that opened across the country during the 1980s and 1990s, it was originally intended as a temporary measure to address an emergency need for food. Two decades later, as a result of escalating demand, food banks have become a permanent fixture in Canada. Today, there are 95 food banks in BC and 550 nationwide (Canadian Association of Food Banks, 2004).

The number of people who use BC's food banks continues to rise. In 1997, approximately 1.5 per cent of BC's population relied on food banks; by 2004, the number of people using food banks had climbed to 2 per cent (Canadian Association of Food Banks, 2004). Each March, the Canadian Association of Food Banks conducts the only national survey of Canada's emergency food programs. In March 2004, the association's *HungerCount* survey found that:

- More than 84,000 British Columbians—or over 32,000 BC households—used food banks during that month, an increase of 16 per cent over 2003.
- More than 26,000 BC food bank recipients during that month were children.
- Almost 8,000 more BC children needed emergency food in March 2004 compared with 2003.
- Seniors represented almost 7 per cent of BC food bank users in 2004.
- A majority of BC food bank users are on social assistance.
- Almost 8 per cent of BC food bank recipients are employed, and 10 per cent receive disability support.

Food banks were created as an emergency response and were never intended to provide a nutritious diet. As they are dependent on donations, the type of food available varies widely from week to week, and month to month. The majority of food is processed or packaged since vegetables and fruit are less likely to be donated than other types of food (Wilson & Tsoa, 2002). Many food banks simply do not have the capacity to store refrigerated products or produce. Nor can food banks accommodate people with medical conditions requiring special diets, such as low-sodium foods for hypertension or low-sugar foods for diabetes.

In order to assist as many people as possible, most BC food banks also limit the number of times each month that an individual or family can access emergency supplies. Six out of ten BC food banks restrict visits to once a month, and the average food bank provides only about four days worth of food in its hampers. Across Canada, 40 per cent of food banks had difficulty keeping shelves stocked in 2003; the following year, that number had risen to almost 48 per cent (Canadian Association of Food Banks, 2003, 2004).

Food banks fill a gap by providing emergency food to people facing hunger, but they are not a dignified means to access food, are nutritionally inadequate, are limited in quantity and quality, and do not build capacity towards increased food security for all. As such, although they are—at present—indispensable, food banks do not constitute a viable solution to food insecurity in BC.

Capacity-Building Community Programs

The following are some examples of initiatives that help those in the community, including those with a low income, access healthy foods. Many of these initiatives are operated by volunteers with short-term grants that are under constant threat of elimination.

- **Urban Agriculture and Community Gardens:** Some British Columbians now grow some of their own food in community plots, in rooftop or balcony gardens, or in their backyards. For those who do not have access to a plot of land, for a small annual fee, they can have

Seed of a Growing Movement

In 1977, a University of Tennessee professor, Robert Wilson, asked the question: If food is as essential as water, housing, and health services, why don't cities have a Department of Food? His work with graduate students showed that cities do not plan comprehensively for food security as they do for other necessities, and this in fact can lead to fragmentation, counterproductive efforts, and few lasting solutions to a community's food problems.

Out of this research and fueled by concerns of feeding visitors to the Knoxville World Fair, Knoxville, Tennessee, became the first community to create a food policy council in 1982. A group of multidisciplinary stakeholders advise the city or regional government about policies related to agriculture, food distribution, food access, and nutrition; work together to coordinate efforts; and provide comprehensive solutions to local or regional food issues.

Since 1982, similar policy councils have been adopted across North America to address the underlying factors impacting food security. The councils don't meet Wilson's original vision of a "Department of Food" as they have limited decision-making power, but they do influence policy.

In Canada, Toronto's Food Policy Council, created in 1991, has produced some of the country's seminal documents on food security issues and solutions. See Food Security Learning Centre (http://www.worldhungeryear.org) and Toronto Food Policy Council (http://www.toronto.ca/health/tfpc_index.htm) for more information.

their plots in a community garden, or they can share a plot and its harvest with others. Fifteen gardens exist in the Capital Regional District. On Vancouver's east side, the 3.5 acre Strathcona Community Garden has been operating on public land for 20 years, providing low-income families with fresh produce they might otherwise not be able to afford. Kamloops has four community gardens, including one specially designed for disabled people. Nanaimo FoodShare operates a popular community garden with communal plots. Gardeners donate fruit and vegetables to charity or share it among themselves (Kalina, 2001). Municipalities are working on garden policies to support community gardens.

- **Fruit Tree Projects:** Each summer and fall, large quantities of fruit rot on the ground in BC because tree owners cannot pick, or have no use for, an overabundance of apples, cherries, pears, and plums. Across the province, volunteer fruit picking occurs in communities like Nelson, Kamloops, Nanaimo, and Vancouver to make use of surplus fruit. Volunteers harvest the fruit, keep a portion for themselves, and distribute the rest to community agencies that help hungry people. In Victoria each year, the non-profit group Lifecycles picks about 31,000 pounds of apples, cherries, pears, plums, grapes, and quince from backyards and divides it into 3 equal portions. One-third is shared between volunteer pickers and tree owners, one-third goes to community agencies such as AIDS Vancouver Island, and the remaining one-third is made into juice that Lifecycles sells to support programs focusing on the issues of health, food, and urban sustainability.

- **Good Food Boxes:** The idea for the Good Food Box started in Belo Horizonte, Brazil in 1993 to address the malnutrition of 20 per cent of the child population. The municipal government began bulk buying of local fruits and vegetables to increase access to healthy food. Today, communities all over BC, both urban and rural, have introduced Good Food Box programs. Mainly run by volunteers, the program provides a weekly or bi-weekly box of fresh fruits and vegetables for an average price of $10. The box is available to anyone, but the majority of customers are low-income. Produce is purchased as much as possible from local farmers, with a commitment to carry in-season food. A typical BC winter box might include broccoli, pears, apples, carrots, and potatoes, while a summer box might contain cantaloupe, cauliflower, and cucumbers. The Good Food Box builds food security in a number of ways. It increases the amount of fruits and vegetables available to those on low incomes, making a healthier diet more affordable. It also helps build a strong, sustainable local food system by supporting local farmers and using organic produce wherever possible (Kneen, 2004). In the South Okanagan and Similkameen, the Healthy Harvest Box, organized by a not-for-profit, food-buying club, is sold to 350 families each week, and the goal for 2005 was to increase that number to 800 or 1,000 (Interior Health, n.d.).

- **Community Kitchens:** Like the good food box, modern community kitchens have roots in South America, where they were established almost 20 years ago in Brazil, Chile, and Peru. The aim of community kitchens is to bring together low-income men and women to share the cost and work of cooking. The kitchens are not a charity, although in many communities, they are sponsored by churches, government agencies, service clubs, or community groups, who often donate cooking space. Groups using community kitchens reduce the cost of food by buying in bulk, and make nutritious soups and casseroles using lentils, beans, and other low-cost ingredients. In addition to providing opportunities to share culinary skills, the kitchens help increase support and self-esteem for those on low incomes, and offer a friendly place to make new friends. Different kitchens cater to diverse needs. In Kamloops, many kitchen participants are single mothers. Single males who rely on Kamloops food banks have formed other collective kitchens. Another Kamloops community kitchen caters to college students living in residence, who may only have access to a hot plate or microwave. One Nanaimo community kitchen matches teenage single mothers with elderly widows. When Kamloops' Community Kitchens were evaluated, they demonstrated positive outcomes, including greater food security through increased access to nutritious food, higher levels of personal skill development, improved self-esteem, and enhanced social support among participants (Kalina, 2001). Another study, however, found that community kitchen programs in Canada have a limited potential to resolve food security issues related to chronic poverty, because they do not substantially alter a household's economic circumstances (Tarasuk & Reynolds, 1999).

- **Community Farmers' Markets:** Years ago, when most of BC's population lived in rural areas, many people relied on farmers' markets to buy food they did not grow themselves. Today, community markets are undergoing a revival. Currently, about 60 markets exist around the province. That number is increasing steadily: in 2000 alone, about 10 new markets were established in BC (BC Association of Farmers' Markets, n.d.). Each community market is unique; some might sell only certified organic produce, others sell both organic and non-organic fruits and vegetables, while many also offer other fresh food, including baked goods, eggs, cheese, fish, chicken, and beef. The markets provide an opportunity for small-scale producers to sell their wares at a price reflecting the real cost of production, and give consumers access to fresh, local foods. A growing trend in urban centres across North America is to have markets set up one day in lower-income neighbourhoods to support better access to healthy foods, helping address the fact that lower-income neighbourhoods often do not have grocery stores nor good access to transportation. These farmers' markets bring local, nutritious foods close to home, provide support for local farmers, and benefit the neighbourhood socially.

National Food Policy Framework

Federal/Provincial/Territorial (FPT) officials in both health and agriculture have developed a number of important documents linked to food policy, such as Canada's Action Plan for Food Security, the healthy eating and nutrition components of the Pan-Canadian Healthy Living Strategy, and the Canadian Food Inspection System Blueprint. However, there have been challenges in implementation of the various initiatives, and in this context, the discussions on a National Food Policy Framework began (Advisory Committee on Population Health and Health Security, 2004).

In April 2004, the FPT Ministers of Agriculture directed agriculture officials to improve the coordination of food policy across Canada and to develop a vision for a strong food sector. They asked that agriculture officials work with counterparts in the health sector, to ensure that a national food initiative took into account health, social, and economic benefits.

The FPT initiative would provide national policy direction for health and agricultural issues in the entire food continuum (farm-to-fork), and would support action on food safety, industry viability and innovation, and healthy eating. Benefits would include better coordination on food safety, decreased incidence of foodborne illness and diet-related disease, increased profitability and innovation in the food sector, and improved consumer confidence in the entire food system (Health Canada, 2004b).

In the October 2004 meeting of the FPT Ministers of Health, Ministers committed to continued work on the framework, and stated that further discussions on the development of a framework would take place in the ensuing months (Canadian Intergovernmental Conference Secretariat, 2004). However, no progress on the development of the Framework has been made to date.

Nutrition and Food Policy in Norway

Nutrition and food policy has a long history in Norway, beginning in the early 1930s with the debate over the interrelation between income, nutrition, and health. In 1937, a National Nutrition Council (NNC) was formed to create a nutrition and food policy.

Beginning in the 1950s, the proliferation of energy-rich foods into the marketplace led to changes in food habits and lifestyles, resulting in a substantial increase in mortality from coronary heart disease. It became clear that changes in nutrition and agriculture policy were needed to improve the health of the population.

In 1974, a White Paper was developed that emphasized the need to align the food supply with policy. This paper supported the development of a coherent food policy that required collaboration across the public sectors, organizations, and industry. The 1974 policy supported implementation of regulatory, financial, and education measures to achieve dietary change. A variety of national strategies were implemented to support the policy. A national nutrition campaign was undertaken, higher education at the university level for nutritionists was implemented, medical education changed, and the agriculture sector was supported to make significant changes in the production and distribution of foods. Agriculture and food policy were also integrated with other economic measures. The policy underwent further development and revision in 1975, 1982, and 1993.

The impact of the Norwegian nutrition and food policy has been significant. Public surveys have repeatedly shown that the population is more knowledgeable about the link between diet and health since the inception of the first food policy. Substantial dietary changes have been reported through a variety of sources such as wholesale food figures and household food consumption surveys undertaken by the National Bureau of Statistics. The agriculture landscape has changed over the years to support the food policy. With regard to the health impact, there has been a 50 per cent and 25 per cent reduction in mortality from coronary heart disease among middle-aged men and women.

The next step in the Norwegian policy is to shift from focusing on a single disease into a broader health strategy (Norum, Johansson, Botten, Bjorneboe, & Oshaug, 1997).

Food Policy Councils: Coordinating Efforts and Resources

With such a complex continuum from farm-to-fork underlying food security, piece-meal efforts, such as food banks and community kitchens, can only make a small dint in the underlying factors that make physical and economic access to food so difficult for some people.

Some communities are mobilizing to create more coordinated, comprehensive approaches so that the whole population of a community, regardless of income or individual resources, has better access to healthy foods. Food policy councils that advise governments can provide an effective forum for all stakeholders to work together to examine the issues. The establishment of a food policy council signals that a community is moving from short-term relief of hunger and malnutrition (e.g., establishing food banks and soup kitchens) to a more long-range, coordinated planning process to help address food insecurity.

The effectiveness of food policies has been demonstrated in many countries. For example, in 1975, Norway adopted a food policy to promote healthy diets, increase local food production and agricultural development, and contribute to world food security. By the 1990s, consumption of fats had decreased by 6 per cent (from 40 to 34 per cent) and the death rate from heart disease had also decreased.

In Canada, food policy councils, such as in Toronto, Vancouver, and Kamloops, have promoted policies and programs aimed at improving food security in the community. Toronto's Food Policy Council promotes a variety of community food security programs designed to provide community access to an affordable, healthy diet, including: community shared agriculture, farmers' markets, good food box programs, community kitchens, community restaurants, community gardens, rooftop gardens, and school food programs. Evaluations of these programs have shown a decrease in social isolation, an increase in fruits and vegetables consumption, an increase in community food self-sufficiency, and an increase in sustainable food production (Community Nutritionists Council of BC, 2004).

In BC the cities of Vancouver and Kamloops have formed food policy councils. The Kamloops Food Policy Council

was established in the mid-1990s when the need for food banks and community gardens began to grow to address the emerging food needs of the city of 85,000 people. The council develops and promotes policies so that everyone has access to a stable supply of nutritious food. It also provides a framework to support local and regional sustainable agriculture and food production (Lobe, 2005).

In Vancouver, the creation of a food policy council was part of a City Food Action Plan devised in 2003. The action plan was established in response to concerns about the current food system, and to help Vancouver become a leader in the development of sustainable food policies and practices (City of Vancouver, 2004b). Vancouver's food policy council is comprised of individuals from widely different backgrounds, and encompasses all sectors of the food system, including production, processing, access, distribution, consumption, and waste management (City of Vancouver, 2004a).

The Vancouver Food Policy Council will examine every aspect of the food system from field to meals, focusing on where and how food is grown, transported, and distributed. One of the council's major objectives is to inform the public about food security issues, and to improve the health and sustainability of local food systems through initiatives such as farmer's markets and encouraging institutional buyers to purchase locally produced food (City of Vancouver, 2004a).

In Victoria's Capital Regional District, a major initiative is underway to create a Food Charter that will encourage residents to think about where their food comes from and how it is produced. The Charter will also outline steps to create a sustainable and secure local food and agriculture system, and to improve access to nutritious and sufficient food (Capital Region Food & Agriculture Initiatives Roundtable, n.d.). A broad range of organizations are involved in forging the Charter. They include the Canadian Cancer Society, the Vancouver Island Health Authority, Small Scale Food Processors Association, and environmental non-profit groups such as the Land Conservancy of BC (Wetzel, 2005).

The growing movement towards a coordinated, comprehensive approach at the community level is an important step in addressing food insecurity, and more BC communities should be supported to establish food policy councils or coalitions that work to support local action for a healthier food system. This is fertile future work for organizations such as the Union of British Columbia Municipalities. However, a similar coordinated effort is needed on a provincial level. It would be highly beneficial to have a coordinated, comprehensive approach for a safe, secure, and sustainable food policy for BC adopted by all the provincial ministries with mandates along the food security continuum. Such a policy could support:

- Local farming, food processing, and distribution.
- Better education on where food comes from, and better knowledge and skills in healthy eating.
- The creation of local access in neighbourhoods to farmers' markets, gardens, and other resources.
- Adequate income assistance rates and initiatives to support healthier food choices.

Since the impacts and origins of food insecurity are multi-dimensional, policy responsibility rests with many ministries and sectors. Dietitian organizations such as the Community Nutritionists Council of BC and the Dietitians of Canada have called for increased inter-ministerial coordination to address food insecurity in BC.

International Action

At the November 1996 World Food Summit, the international community, including Canada, made the commitment to reduce by half the number of hungry and undernourished people no later than the year 2015. In response to the World Food Summit, Canada developed an Action Plan for Food Security containing plans and steps Canada could take to improve food security both domestically and internationally (Agriculture and Agri-Food Canada, 1998). This plan was launched on October 16, 1998, and a Food Security Bureau was established in February 1999 under the auspices of the federal Agriculture and Agri-Food Canada.

Unfortunately, apart from two progress reports in 1999 and 2002, little has been done to truly implement the plan and to date there are few tangible results. More federal attention needs to be placed on food security as a determining factor underlying the health of Canadians.

Summary

- Food security exists when all people at all times have physical and economic access to sufficient, safe, and nutritious food to meet their dietary needs and food preferences for an active and healthy lifestyle (FAO, 1996).
- The inability to access healthy food, termed *food insecurity*, affects a number of British Columbians either because they lack the economic means to purchase healthy foods and/or because they live in remote BC locations.
- In 2001, 17 per cent of BC's population could not afford the quality or variety of food they wanted, worried about having enough to eat, or even went hungry in the previous 12 months. This was higher than the national average of 15 per cent.
- Factors affecting the ability to afford nutritious food in BC include higher costs of living for a basic "market basket" of items, higher housing costs, inadequate social assistance rates, increased levels of homelessness, and a minimum wage level that can result in even full-time workers in some BC communities falling below the federal poverty line.
- Hunger and malnutrition are physically damaging to all people, but some populations are particularly vulnerable. Children, seniors, and pregnant women are at increased risk of disability, poor health, and even death from insufficient caloric and nutritional intake. The fetuses of pregnant women can be permanently damaged from malnutrition.
- Families and individuals on social assistance in BC have little or no money after paying for shelter to purchase food and other necessities.
- Along with the inability to purchase healthy food, individuals with inadequate income experience other barriers to eating and preparing healthy food, including reduced access to grocery stores or fresh produce in their low-income neighborhood, and a lack of transportation to food outlets. Homeless individuals usually have no cooking or food storage facilities, forcing them to live from hand to mouth for every meal.
- A number of initiatives are available in some communities, such as school meal programs, food banks, community gardens and fruit tree programs, community kitchens, and good food boxes, but these initiatives are often not accessible to all in need, are piece-meal at best, and are not funded in a sustainable manner.
- The growth of community food policy councils, which bring a diversity of stakeholders together, is helping to create a more coordinated and comprehensive approach to address food insecurity at the community level.
- More work needs to be done at the community, provincial, and national level to address the underlying cause of household food insecurity—poverty.

Chapter 5:
The Safety and Sustainability of Food and the Food Supply

The food we eat must not only be nutritious and be consumed in the right proportions to maintain health; it must also be safe to eat. The potential public health impact of unsafe food is significant, capable of harming both individuals and large sectors of society. Food can be unsafe for consumption in many ways—through contamination with pathogens, toxins, or chemicals on the farm; during distribution, food processing, and retail operations through improper storage; or through unsafe food preparation in the home. Ensuring the safety of the food supply requires a "farm-to-fork" risk management approach that guards against risks or removes them at each point along the continuum that food travels from being grown, raised, or harvested to the time it is consumed.

Foodborne Diseases

Food has long been recognized as a possible source of illness. Although we know a great deal about food poisoning and how to prevent it in the 21st century, foodborne illness and food contamination still create widespread illness and death in the world. The most common causes of foodborne disease are:

- Bacterial, viral, or parasitic infections;
- Toxins in food created by bacterial growth, such as in the case of botulism or *E coli* 0157:H7, or toxins created by harmful algae species, mostly in seafood and shellfish or mycotoxins created by certain molds; and
- Chemical contaminants.

In BC and Canada, foodborne illness is estimated to occur far more frequently than actually reported. Individuals can experience episodes of gastrointestinal upset, diarrhea, or what many term "stomach flu," and be unwell for a day or two. An unknown but substantial proportion of these are thought to be due to contaminated food. Such individual cases are usually short-lived and rarely lead to a confirmed diagnosis.

Most cases of foodborne illness are only recognized when at least two or more people become sick after eating a meal or food product in common. Symptoms can arise hours or even days after the food is consumed. Every year a provincial or national outbreak occurs in which a group of individuals get sick from a certain foodborne pathogen. The Canadian Food Inspection Agency reports that each year about 10,000 cases of foodborne illness are reported from which approximately 30 people die (Canadian Food Inspection Agency, [CFIA], 2005c).

According to the World Health Organization (WHO), a small number of factors related to food handling are responsible for a large proportion of foodborne diseases worldwide. The most common factors are:

- Preparation of food several hours prior to consumption, combined with improper storage at temperatures which favour the growth of pathogenic bacteria and/or the formation of toxins;
- Insufficient cooking or reheating of food to reduce or eliminate pathogens;

Golden Rules for Food Handling

The World Health Organization has developed ten rules for safe food preparation that, if followed, greatly reduce the chance of anyone becoming sick from foodborne illness:

1. Choose foods processed for safety, i.e. pasteurized products over unpasteurized.
2. Cook foods thoroughly.
3. Eat cooked foods immediately.
4. Store food promptly and carefully. Perishable foods should be kept at below 4°C until ready to cook or eat. Bacteria can grow and spoil food left in temperature 4°C to 60°C. For more information, visit Canadian Food Inspection agency at http//www.inspection.gc.ca.
5. Reheat cooked foods thoroughly.
6. Do not allow any contact between raw food or its traces and cooked food.
7. Wash hands repeatedly.
8. Keep all kitchen surfaces meticulously clean.
9. Protect food from insects, rodents, and other animals.
10. Use safe water.

The BC HealthFile's tips on safe food handling generally follow the above list but add a few other cautions:

- Do not let anyone with diarrhea or infected sores prepare food.
- Wash all fruits and vegetables before eating.
- If in doubt, throw it out! (Ministry of Health Services [MOHS], 2001)

- Cross-contamination of food; and
- People with poor personal hygiene handling food.

These food safety risks can be avoided with safe food handling.

Risk from Food Pathogens in BC

The World Health Organization has identified more than 45 pathogens that are linked with foodborne illness and disease. Not all of these are health risks in BC or Canada. In general, the symptoms and dangers of all food poisonings are much more severe in infants, young children, the elderly, and immune-compromised individuals. The most common food pathogens[1] in BC are:

Norovirus

Norovirus is a very small virus that can cause food poisoning illness when present in food or water. After ingesting as few as 5 to 10 viral particles of this tiny virus, most people will develop symptoms of severe vomiting and diarrhea within 12 to 60 hours. This illness often causes severe dehydration and may become serious in young children and the elderly. Norovirus has often been called the Norwalk-like virus. While the usual transmission of the virus is person-to-person, the virus can also be present in foods contaminated by someone who is sick with the virus. Some foods eaten raw, like oysters, can become contaminated with the virus, and cause large outbreaks. Other foods that have been involved in transmission of the virus include salads, sushi, and catered meals of sandwiches and wraps. Norovirus was identified in food or ill persons in 50 per cent of all foodborne illnesses in BC from 2000 to 2004 (Figure 5.1). The Centers for Disease Control and Prevention in Atlanta, Georgia, estimate that Norovirus causes 50 per cent of all foodborne outbreaks in the United States (Widdowson et al., 2005). This estimate appears to be consistent with British Columbia's experience.

Bacillus cereus

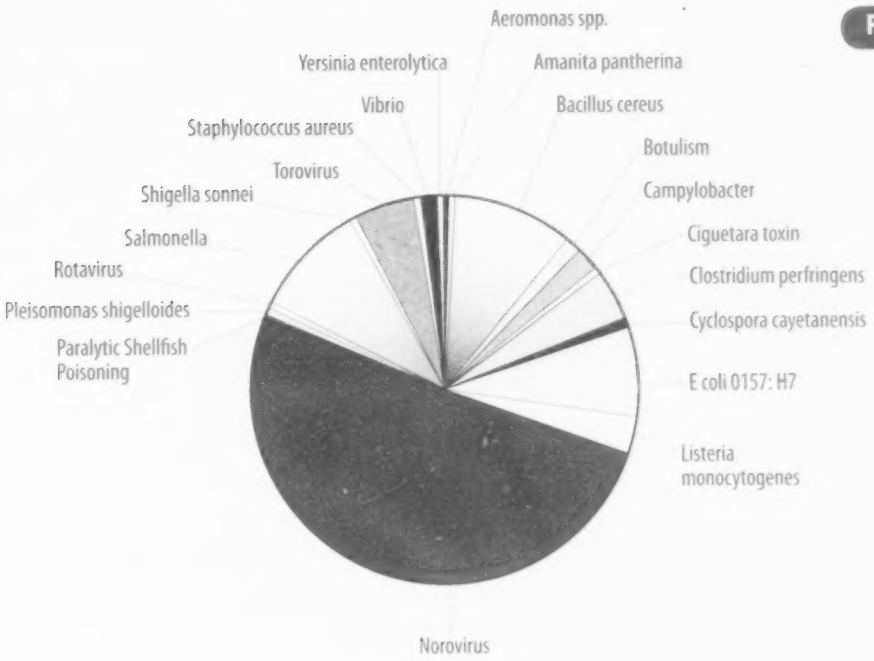
Bacillus cereus is a gram-positive, rod-shaped bacterium that, after Norovirus, is the leading cause of bacterial food poisoning in BC. From 2000 to 2004, *Bacillus cereus* was traced to 20 incidents of food poisoning, and was also associated with a further 5 incidents, causing over 200 illnesses. Chinese food, which was predominately purchased as take-out and from restaurants, was involved in 60 per cent of these illnesses.

Bacillus cereus bacteria are commonly found in soil and many foods, particularly grains like rice that can become contaminated with the organism. If the food is stored in a warm, wet environment, the spores can germinate and the vegetative cells of the bacteria grow, resulting in high numbers of the bacteria. When the bacteria are in high enough in numbers, they produce toxins, which can cause diarrhea and vomiting. Sometimes heating can destroy the toxins, but since some toxins are resistant to the heat, even cooking food thoroughly may not help. That is why it is so important to make sure that cooked food is rapidly cooled to 4 °C (recommended "cold-holding" temperature).

Two other types of common food poisoning, *Staphylococcus aureus* and *Clostridium perfringens*, also share the same characteristics of *Bacillus cereus*.

[1] *In most cases, the information provided is from Canadian Food Inspection Agency's factsheets.*

Organisms Causing Food Poisoning in BC, 2000 to 2004



Source: BC Centre for Disease Control, 2004.

Figure 5.1

From 2000 to 2004, Norovirus was responsible for 50 per cent of all foodborne diseases in BC.

Together, these three organisms were responsible for 38 confirmed incidents of food poisoning in BC, causing 290 illnesses between 2000 and 2004. This figure likely underestimates the actual amount of disease these organisms cause by at least 10-fold, as illnesses can only be confirmed when leftover foods or clinical samples are submitted to the food poisoning reference laboratory at the BC Centre for Disease Control.

Enterohemorrhagic E.coli

Of the more than 50 different strains of the bacteria *Escherichia coli*, only a few are harmful. The sub-strain enterohemorrhagic *E.coli* (EHEC), also called verotoxic *E.coli*, produces a toxin that can cause vomiting, diarrhea, and fever and, in severe cases, bloody diarrhea, kidney failure, and potential death from hemolytic uremic syndrome.

One particularly virulent EHEC strain, *E.coli* 0157:H7, first identified in 1982, has become a major public health threat worldwide. It lives harmlessly in the gut of cattle and deer, but can contaminate food or water supplies through contact with infected intestinal contents or manure. Raw or undercooked hamburger, unpasteurized milk or juice, unwashed fruits and vegetables that have been fertilized with infected cow manure, or poor handwashing are the most common sources of infection. The presence of just 10 bacteria can cause infection. In 2 to 7 per cent of infected individuals, particularly the elderly and children under the age of 5, the infection progresses to hemolytic uremic syndrome, characterized by acute kidney failure and the risk of death. In recent years, BC has had cases linked to undercooked hamburger, unpasteurized

Oysters and Norovirus in BC

From January to March 2004, oyster consumption was associated with clinical illness in 79 individuals from 68 separate incidents in BC. Oysters were eaten raw (73 per cent of cases), pan fried (10 per cent), and deep-fried with batter (8 per cent). Norovirus was found in leftover oysters still in the shell and those previously shucked sold in plastic tubs. The oysters were traced back to at least 14 different harvest sites, 18 suppliers/producers, and 45 different points of purchase. This outbreak suggests that oysters were contaminated with Norovirus over a geographically dispersed area in the Pacific Northwest by an unknown source (David et al., 2006).

What is Good Handwashing?

Use soap and warm water and create a good lather, and wash your hands for about 20 seconds (the time it takes to sing the "happy birthday" tune). You should wash your hands this way particularly after using the toilet, or when you touch potentially contaminated surfaces.

Sprouts Risk

In recent years, raw sprouted seeds and beans have been linked to outbreaks of foodborne illness, caused by *Salmonella* and *E.coli* 0157: H7 in North America, Europe, and Japan. The bacteria can become lodged in tiny cracks of the seeds and then multiply in the warm, humid conditions needed to sprout the seeds.

Manufacturers are working with the Canadian Food Inspection Agency to remove the risk, but the safest course of action is to thoroughly cook sprouts in stir fries or soups (CFIA, 2000).

apple juice, unpasteurized goat milk, and tainted salami. Although the Canadian Food Inspection Agency routinely tests hamburger meat and issues recalls when *E.coli* are found, there is no guarantee that all hamburgers meat is bacteria free. The dangers of *E.coli* can be removed by thorough cooking (for example, internal temperature of hamburger patties should reach 71° C), pasteurizing, and careful handling of food products.

Staphylococcus aureus

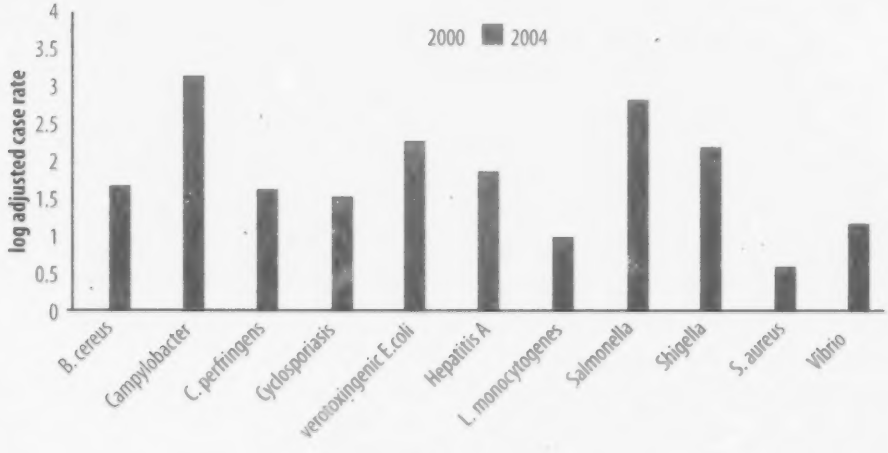
Causing an estimated 25 per cent of all food poisonings, *Staphylococcus aureus (S. aureus)* bacterial strains that cause food poisonings are characterized by one virulence factor—the ability to produce staphylococcal enterotoxins (SEs). Other *S. aureus* bacterial strains (not related to food poisoning) can cause conditions from skin infections to toxic shock syndrome, and are important pathogens in the community and hospitals. *S. aureus* is found in the nostrils, skin, and hair of warm-blooded animals, and up to 30 to 50 per cent of the human population are carriers. Contamination of food from poor hygiene, coupled with improper temperature storage of foods, can create conditions that allow *S. aureus* bacteria to multiply to levels that allow SEs to be released from the bacteria into food. So far, 14 different types of SEs have been identified (Le Loir, Baron, & Gautier, 2003). Symptoms usually have a violent onset—usually about 2 to 4 hours after eating the food, but onset may be as short as 30 minutes or up to 8 hours later. The symptoms are severe nausea, vomiting, cramps, and prostration, often with diarrhea and sometimes lowered blood pressure and lower body temperature. Symptoms are short-lived—usually about 24 hours—but the intensity can be extreme.

The foods most likely to become contaminated are those that come in contact with food handler's hands without further cooking: pastries, custards, dips and dressings, sandwiches, cheese, and sliced meats. The source can be a food handler

Figure 5.2

A Comparison of Reported Pathogens Associated with Foodborne Diseases in BC, 2000 and 2004

The BC Centre for Disease Control investigates outbreaks of food poisoning in collaboration with the regional health authorities. Reportable communicable diseases associated with food poisoning, and investigations into outbreaks, reveal that in general, rates for some foodborne diseases have dropped since 2000 while others have increased (Figure 5.2).



Source: BC Centre for Disease Control, 2004.

who carries the organism, or an infected cow, which contaminates milk or cheese. It is important not to leave risky foods sitting unrefrigerated for more than two hours.

Salmonella

Salmonella bacteria cause a sudden inflammation of the intestine (enterocolitis) combined with a sudden onset of headache, abdominal pain, fever, diarrhea, nausea, and sometimes vomiting. In severe cases, the infection, called salmonellosis, can cause septicemia or can localize into a tissue of the body causing inflammation of the joints, heart, lungs, brain, or kidneys. Deaths are rare, but the very old, very young, or immunocompromised individuals are at risk of death, especially from rapid dehydration. Healthy individuals can be weakened and experience diarrhea for days.

Health Canada reports more than 6,000 cases of *Salmonella* in Canada each year. More than 2,400 recognized serotypes of the bacteria *Salmonella* exist and are carried by a wide range of domestic and wild animals including poultry, swine, and cattle, and pets such as dogs, cats, turtles, iguanas, and rodents. The United States Centers for Disease Control and Prevention have recently simplified the categorization of *Salmonella* into two major species, *S. bongori*[1] and *S. enterica*, with the latter the most common source of human infection. Infections from these species generally arise from contact with food from infected animals or with food that has been contaminated by the infected feces of an animal or person. Adequate cooking and proper washing of hands and surfaces can eliminate the bacteria. The most common sources of infection are raw or undercooked eggs, unpasteurized milk and other dairy products, undercooked or contaminated poultry or raw poultry juices, or contaminated meat products. Fruits and vegetables, particularly melons and cantaloupes, which have been contaminated by infected manure and dirty utensils and cutting boards, can also be sources of infection.

Campylobacter

More than 20 different strains of the bacteria *Campylobacter* exist; they are most commonly carried by cattle and chicken, but are also found in puppies, kittens, pigs, and some wildlife. The microbe is thought to be responsible for 5 to 14 per cent of all cases of diarrhea worldwide. Two strains—*C. jejuni* and *C. coli*—are the most common. It is estimated that close to 100 per cent of poultry carry *C. jejuni*. Modes of transmission include eating undercooked meat, particularly poultry, cross-contamination from cutting boards and cooking implements, as well as poor handwashing after handling infected animals or meat. Transmission through contaminated water also occurs. The resulting human illness, campylobacteriosis, is characterized by diarrhea, abdominal pain, malaise, fever, nausea, and vomiting. A rare paralysing neurological condition, Guillain-Barre Syndrome (GBS), in which the immune system attacks the myelin sheath around peripheral nerves, has been shown to occur in about 1 to 2 of every 2,000 cases of *Campylobacter* infection. There are about 80 GBS cases a year in BC, of which about 30 per cent (about 24 cases a year) may have had a *Campylobacter* infection as a precursor. As a general

[1] *S.bongori is most often found in cold-blooded animals, such as lizards, but has been isolated from pigeons and in rare cases can be cultured from infants less than 13 months old.*

Emerging Foodborne Pathogens

In recent years, organisms previously unrecognized as foodborne are emerging as potential risks in the food chain, including:

- ***Helicobacter pylori*** – Prior to 1982, stomach ulcers were thought to be created by stress, spicy food, excess stomach acid, and lifestyle. Now it is known that spiral-shaped helicobacter bacteria create 90 per cent of duodenal ulcers and 80 per cent of gastric ulcers. Treatment is typically 2 weeks of antibiotics and a drug to suppress stomach acid to allow the ulcer to heal. Although its transmission routes are not clear, there may be a significant foodborne component, particularly from infected adult food handlers to children.
- ***Arcobacter butzleri*** – This organism, found primarily in cattle and poultry, is related to the Campylobacter family; it grows at cooler temperatures, causing similar disease.
- ***Cyclospora*** – This is a one-cell protozoan parasite previously found only in tropical settings. *Cyclospora* outbreaks have occurred in recent years in Canada and the United States, and are linked to raspberries, mesclun lettuce, cilantro, and perhaps basil. Symptoms are primarily severe diarrhea, loss of appetite, and stomach cramps.
- ***Cryptosporidium parvum*** – Long associated with waterborne outbreaks, this protozoan parasite lives in the intestines of cows and forms a durable cyst that may contaminate food, through manure fertilization of fruit and vegetables, or infected food handlers.

Infection from these emerging foodborne pathogens is likely prevented by good handwashing and safe food preparation (Meng & Doyle, 1997; Lehner, Tasara, & Stephan, 2005).

Pork: Trichinellosis Disappearing

For centuries, the roundworm *trichinella* was an endemic public health threat, carried by pigs and infecting humans through undercooked pork. Larva from the worm would migrate through tissue, forming cysts in the muscle of both the pig host and humans who ate infected pork meat. The infected human would experience pain, swelling, fever, and fatigue. The infection, called trichinellosis, could even cause death if enough cysts were consumed.

The rule "don't eat pink pork" became dogma. In the last few decades, largely by a change in farming practices so that pigs are no longer fed meat and table scraps, *trichinella* has essentially disappeared from modern pork production. There has not been a confirmed case of trichinellosis from eating infected pork in Canada for more than 15 years (Canadian Pork Council, 2005).

However, trichinellosis has not disappeared completely, and it is now linked to eating undercooked wild meats, particularly bear, wolf, and artic marine mammals in Canada. In BC, there were no cases of trichinosis in 2004; however, in 2005, 27 cases were traced to the consumption of bear meat (McIntyre et al., 2006).

rule, all chicken and hamburger should be cooked until the internal temperature reaches 71°C (160°F) for ground beef and meat and 74°C (165°F) for poultry (British Columbia Centre for Disease Control [BCCDC], n.d.).

Listeria monocytogenes

Listeria is a rod-shaped bacteria commonly found in soil, mud, water, and the forage food of ruminants like cows and sheep. It most often causes foodborne illness outbreaks through unpasteurized soft cheese. Unlike other bacteria, its growth is not inhibited by refrigeration. Infection can cause headache, muscle-aches, fever, and gastrointestinal upset. More severe infections can lead to meningitis and/or septicemia. It is particularly dangerous to pregnant women, often causing miscarriage or stillbirth, or can infect the newborn, causing meningitis or septicemia for the infant, often with fatal consequences. In 2002, BC had two serious outbreaks of listeriosis, both linked to small cheese producers on Vancouver Island (BCCDC, 2002).

Clostridium botulinum

This bacteria, which is responsible for botulism, produces a potent toxin when it multiplies. Botulism is a severe and life-threatening food poisoning marked by nerve impairment and paralysis, including respiratory paralysis. Up to 10 per cent of affected people die. The first symptoms can be double or blurred vision, difficulty swallowing, and dry mouth. Vomiting and diarrhea may also be present initially. Some victims of the poisoning may need to be supported by a respirator—sometimes for months—until the toxin is cleared. Long-term disability can occur as a result.

C.botulinum spores are ubiquitous in the soil worldwide and they thrive in a moist, oxygen-free, low pH environment. Improper food processing, particularly home canning of low acid foods (e.g., asparagus, corn, beans, mushrooms), or alkaline conditions promote the growth of this bacteria. Foods suspended in oil, such as garlic, chili peppers, sun-dried tomatoes, and herbs should be dried, acidified, or refrigerated to prevent the development of toxins. Baked potatoes cooked in foil should be served hot or refrigerated. Home-canned and fermented fish have also been linked to outbreaks. The toxin is very powerful—1 teaspoon could kill 100,000 people (MOHS, 2002). Damaged or bulging cans may be a sign that the contents harbour the toxin. High temperatures destroy the toxin, so people using home-canned foods should boil them for 10 minutes before use.

Clostridium perfringens

Another spore-forming, toxin-producing bacteria, *C.perfringens* is found in soil, dust, sewage, and the intestinal tracts of animals and humans. The organism is most often a problem in leftovers that have been left to stand unrefrigerated for more than two hours, most commonly cooked beans and meat gravies. Generally a mild disease of short duration, the food poisoning is marked by stomach pain, nausea, and diarrhea. It is most commonly associated with catering companies, schools, and other institutions that do not have adequate refrigerated storage space. Along with *B. cereus* and *S. aureus*, this organism causes illness through improper temperature storage of food.

Yersinia

Two species of this bacteria cause food poisoning: *Y. enterocolitica* and, less commonly, *Y. pseudotuberculosis*[5]. Both types are found most commonly in undercooked pork, unpasteurized dairy products, and contaminated water. Outbreaks have also been linked to contaminated tofu. The infection, called yersiniosis, usually arises three to seven days after eating contaminated food. Symptoms vary depending on the age of the infected person. Children are the most commonly affected and have symptoms of abdominal pain and diarrhea, which is often bloody. Older children and adults can have right-sided abdominal pain and fever, which may be confused with appendicitis. In rare cases, it may cause arthritis-like joint pain, rash, and sometimes blood poisoning. It usually resolves on its own but in more severe cases it may need to be treated by antibiotics. BC had two outbreaks of yersiniosis, one in 1998, which affected 74 people, and one in 1999, which affected 47 people. Although in both cases the contaminated food was never definitively confirmed, in the first outbreak, there was a strong association with homogenized milk, and in the second, dry fermented salami (Public Health Agency of Canada, 1999,2000).

Toxoplasma gondi

Another protozoan parasite rarely linked to foodborne illness is *Toxoplasma gondi*, which infects a wide range of birds, mammals, and humans but only reproduces in the intestines of domestic and wild cats or other felines. This parasite produces a very durable cyst that is shed in cat feces; the cyst can exist in the environment for a year or more. Human infection is primarily through contact with infected cats, but eating undercooked meat from an infected grazing animal—particularly pork, goat, lamb, and mutton, and, more rarely, beef—is a possible route of transmission. Cysts in the meat can remain infective for years, perhaps for as long as the life of the animal. Infection at the tachyzooite stage of the lifecycle can occur through drinking unpasteurized milk from an infected animal, such as unpasteurized goat's milk.

Infection is marked by swollen lymph nodes (lymphadenopathy) and flu-like illness with fever and malaise. Some people who are infected show no symptoms at all. The parasite can migrate through tissue in the body and lodge in places such as the brain, retina of the eye (causing blindness), or the heart (causing inflammation of the heart muscle). The infection can remain dormant for years and reactivate only if the person's immune system is suppressed. It is particularly dangerous to immunocompromised individuals and to a developing fetus (the infection can cause severe brain damage to the fetus). Infection through meat consumption is more common in Europe than in Canada, particularly in France; as a result, all pregnant women in France are screened for the organism. BC's largest outbreak of toxoplasmosis was in 1995 in Victoria, and was associated with drinking water, not food.

Marine-based Food Poisoning

A number of marine organisms exist that can cause food poisoning in humans. In BC, the one that has the most harmful potential is paralytic shellfish poisoning (red tide), which is described in more detail in Chapter 6 for its impact on Aboriginal population. Blooms of the dinoflagellate

No Honey for Infants

C.botulinum can exist in honey. The bacteria or its spores do not grow in the honey, but if given to infants under the age of one, they can grow in the baby's intestine.

C. botulinum spores from other sources, such as soil, can also begin dividing in an infant's intestine. The illness usually begins with constipation followed by lethargy, listlessness, loss of appetite, poor head control, and weakness (floppy baby). Infant botulism is now the most common form of botulism in North America. Some studies estimate 5 per cent of all sudden infant death syndrome may be intestinal (infant) botulism (Chin, 2000).

BC's Worst Botulism Outbreak

In 1985, a botulism outbreak was linked to chopped garlic in soybean oil used in two popular sandwiches at a well-known downtown Vancouver restaurant. In error, the product had been left unrefrigerated for months before being opened. The outbreak occurred in two clusters, separated by about 3 weeks, and a total of 34 people were affected, 7 of whom needed life support. What was unusual about the outbreak was the slow onset of symptoms, some arising more than 10 days after eating the sandwich. Some of those affected were tourists who only came down with symptoms once they had returned home to the Netherlands and the United States (Centers for Disease Control and Prevention, 1985).

[5] *The bubonic plague is caused by another species, Y. pestis, and is transmitted by fleas.*

Infections Passed by Unsafe Food Handling

While not essentially foodborne illnesses, many common human diseases can be passed from one person to another through unsafe food handling, particularly poor personal hygiene. Cholera and typhoid fever can be passed by food contaminated with the feces or urine of infected food handlers. In BC, the most significant public health risks for disease transmission from infected food handlers are Hepatitis A and shigella.

Hepatitis A

Hepatitis A is caused by an RNA virus that attacks the liver, and is sometimes spread by infected food handlers as a result of poor handwashing. The infection can be acquired when people travel to countries with poor hygiene practices. Once infected, a person can pass the virus on to others for two weeks or more before they know they are infected, and can be infective up to one week after getting sick. Onset of symptoms is rapid, including fever, dark urine, and abdominal discomfort, and jaundice a few days later. Hepatitis can also be passed by sewage-contaminated water, or shellfish exposed to sewage.

Shigella

Shigella is a bacterium found in the intestinal tracts of humans. It causes shigellosis, a flu-like illness that usually appears about three to seven days after eating contaminated food. Cooking will destroy the organism, so the most common contaminated foods are cold salads (pasta, potato, tuna, shrimp, turkey, fruit, etc.) (CFIA, 2006).

algae *Alexandrium* create a toxin that is absorbed by filter-feeding shellfish and bivalves, contaminating them and making them potentially fatal to humans who eat them.

A second toxin is ASP (amnesic shellfish poisoning). This is caused by blooms of the diatom *Pseudonitzia* producing a toxin called domoic acid. ASP symptoms include nausea and vomiting,as well as neurological effects, and has been linked to memory disorder. This toxin was first described during an outbreak in eastern Canada in 1987, which caused 100 illnesses and 3 deaths.

Another toxin-based poisoning is ciguatera poisoning, which occurs in tropical fish that have eaten toxin-producing algae. British Columbians are usually only affected when travelling to hotter climates; the last case of ciguatera food poisoning in BC was due to a BC resident bringing back red cod from Fiji.

Another form of fish and seafood-related food poisoning is Scombroid, also called histamine poisoning; it most often occurs when fish of the Scombridae family (tuna, mackerel) are spoiling or decomposing. Fish in this family contain high levels of histidine, and at temperatures above 4°C, spoilage bacteria release enzymes that convert the histidine to histamine. When eaten, it creates an allergic-like histamine reaction in the individual, creating hives, itching, flushed face, swelling, stomach pain, and even nausea and vomiting. Symptoms may have to be treated by an antihistamine. The best way to avoid Scombroid is to keep fish well-refrigerated and to eat it promptly before any decomposition can take place.

Vibrio parahaemolyticus

In the summer of 1997, over 100 people became ill with gastroenteritis caused by a naturally occurring environmental bacterium, *Vibrio parahaemolyticus*. Self-harvested oysters were traced to approximately 50 per cent of the cases, and the oysters were harvested from several different coastal BC areas. After this outbreak, surveillance and other control measures for shellfish harvesting were implemented by Environment Canada, the Canadian Food Inspection Agency, Fisheries & Oceans Canada (DFO), and the Province of BC.

In 2005, only 6 of the 10 *Vibrio* illnesses were traced to local BC shellfish consumption, 50 per cent of which were traced to self-harvesting oysters. To minimize the risk of consuming unsafe oysters, consumers should only harvest shellfish in approved open areas at the water's edge after a receding tide, use treated drinking water to rinse shellfish, and wash hands after handling raw seafood. Cooking oysters to an internal temperature of 60°C (140°F) for at least 5 minutes will destroy the *Vibrio* bacteria (Fyfe et al., 1997). To check if an area is open for shellfish harvesting, call toll free at 1-866-431-3474, or visit the DFO website at http://www.pac.dfo-mpo.gc.ca.

Public Health Issues in Food Farming

The way we raise and grow our food can have a direct bearing on the quality of the food and the likelihood that it may harbour or transmit foodborne illness. Over the last four or five decades dramatic changes have taken place in Canada and the world in the way food is produced.

Food globalization has also introduced consumption of food from a much larger growing circle than in the past. Some of these changes have improved the quality of the food we eat, reduced foodborne pathogens, and increased efficiency and productivity. But these changes have also had their downside, with adverse impacts on the environment, the introduction of new contaminants to the food supply, or an increase in the prevalence of microbial contamination of herds or crops.

Changes in Farming

Over the last few decades, the small family farm has been quickly disappearing, to be replaced with fewer, larger, and more industrialized farms. This trend to fewer, larger farms has taken place in all agricultural commodities. According to Statistics Canada, the number of farms in Canada declined from 318,361 in 1981 to 246,923 in 2001, albeit, with increased productivity (Statistics Canada, 2004). In 1935, an average Canadian farm produced enough food for 11 people; by 1994, it produced enough for 123 people (Statistics Canada, 1999a).

Poultry farming is a good example of the trend to fewer, larger farms, with more animals on smaller plots of land. The number of poultry farms in Canada declined from 8,700 in 1981 to 4,900 in 2001, but the number of birds on the farms rose from 89 million to 124 million in the same period. That translates into 39 per cent more birds on 43 per cent fewer farms (Mwansa, 2004).

Many people idealize the life of the small family farm and decry the growing industrialization of farming. Both small and large farms have strengths and weaknesses, and their own public health concerns. Running a small family farm is a hard life with demanding physical labour and economic hardships. Many of the health concerns that derive from large-scale factory farming (for example, bacterial contamination and concerns over antibiotics and hormonal residues) also exist, albeit usually on much smaller scale family farms. For example, poorly handled manure infected with *E.coli* 0157:H7 can cause an outbreak of disease whether it comes from a small or large farm. In fact, the *E.coli* that contaminated the aquifer in Walkerton, Ontario in 2000, killing 7 people and infecting thousands, came from a small family farm of less than 100 cattle (O'Connor, 2002).

Being able to feed more people, at a lower cost, on less land, with more systematic processes, in general, is a positive step forward for human health; nutritious food is more readily available at a more competitive price and farmers can generally make a better living. However, the increasing industrialization of farming over the last half century, while increasing the productivity and economic viability of farming, has created some new types of public health concerns, both through the concentration of large numbers of animals on small plots of land and in the increasingly industrialized nature of raising crops.

Intensive Livestock Operations

The industrialization of the raising of farm animals poses some public health risks. This farming approach to raising meat has a number of different names. In Canada it is most often called intensive livestock operations (ILOs) or confined feeding operations (CFOs). In the United States it is most often called Confined Animal Feeding Operations (CAFOs.)

Manure-linked Deaths

Highly publicized disease outbreaks in recent years in North America have been linked to manure contamination of water supplies and juice.

In May 2000, heavy rains washed cattle manure into a shallow well in Walkerton Ontario, contaminating the town's aquifer. Approximately 2,700 people were infected with hemorraghic *E.coli*, 65 were hospitalized, and 7 died (PHO, 2000b). The farmer was found to have followed safe manure handling practices and was deemed not at fault; rather the unsafe operation of the water system was found to be at fault (O'Connor, 2002).

In 1993, 400,000 people in Milwaukee were infected with the parasite *Cryptosporidium* and an estimated 100 people died, most of them elderly or immunocompromised. The source of the Milwaukee outbreak was attributed to the manure-laced run-off from nearby cattle farms contaminating the water supply at one of the city's two water treatment facilities (Hoxie, Davis, Vergeront, Nashold, & Blair, 1997).

Manure residues with *E.coli* have also tainted unpasteurized juices and fruits and vegetables, leading to outbreaks of disease and deaths. In 1996, three outbreaks of *E.coli* 0157:H7 made 86 people sick and killed 1 child after they consumed unpasteurized apple juice. It is believed the apples were contaminated after falling to the ground (Ministry of Health, 2000).

Ammonia Emissions in the Lower Fraser Valley

In 2000, it was estimated that 75 per cent of all ammonia emissions in the Lower Fraser Valley were due to cattle, pig, and poultry housing; manure spreading and storage; and inorganic fertilizer application. Environment Canada is working with agricultural producers and other stakeholders to find solutions to the ammonia emissions. Some options being considered included transporting manure to areas that have lower levels of nitrogen, and changing poultry diets to reduce the nitrogen content of manure. Airshed plans and stricter control of nitrogen and sulphur oxide emissions in this region are also recommended (Environment Canada, Manure Causing White Haze, n.d. as cited in PHO, 2004).

Hog, cattle, poultry, and dairy farming are all experiencing an ILO approach. According to the United States Environmental Protection Agency, an ILO or CAFO is a farm operation that has more than 1,000 beef cattle, 2,500 hogs, or 100,000 hens. In the United States, an estimated 54 per cent of all livestock are concentrated on 5 per cent of the farms (Gollehon, Caswell, Ribaudo, Kellogg, Lander, & Letson, 2001, as cited in American Public Health Association, 2003).

Exact figures are not available for Canada, but it is estimated that similar trends are taking place here. In the case of hogs, the animals are raised entirely in closed buildings from birth to slaughter. In cattle, the animals are raised on pasture and then usually shipped to more confined "feedlots" for final feeding six months prior to slaughter.

The public health concerns of these intensive livestock operations include manure production and handling; the use of antibiotics and hormones to promote rapid growth and to stem the spread of disease from so many animals in close quarters; the potential for infectious disease to take hold; and the creation of air pollution.

The Canadian Public Health Association (CPHA) and American Public Health Association (APHA) have both passed resolutions regarding ILOs/CAFOs. The CPHA in 2000 called for a national approach to ILO regulation, in particular because regions with the least environmental controls or regulations may be the most economically attractive to producers. The APHA in 2003 called for a precautionary moratorium on new CAFOs because there is insufficient data whether public health risks are adequately protected. The Canadian Medical Association has called for a moratorium on large hog farms until more studies have been conducted to assess the risks. Potential public health risks are described in the following sections.

Manure

Farms with large concentrations of animals produce huge amounts of manure every single day. In 1996 (the most recent figures available), Statistics Canada estimated that Canadian livestock produced 361 million kilograms of manure daily, or some 132 billion kilograms a year. No doubt this amount has increased in the last decade (Hofmann & Kemp, 2001). American studies estimate that 575 billion tonnes of animal manure are produced annually on American ILOs/CAFOs.

British Columbia does not have as many ILOs as Alberta, Ontario, and the Prairies, so the concern over the creation of large amounts of manure is not as acute here as in other provinces. According to Statistics Canada, only the Fraser Valley has locations where manure concentration are at the highest level of more than 2,000 kilograms of manure per hectare of land. While even small amounts of manure improperly handled can spread disease, huge concentrations may exceed the capacity of the land to absorb the nutrients or create problems in its safe and effective disposal.

Refuse from animals includes not only fecal matter but straw and bedding soaked in urine and other waste. While manure does contain valuable nutrients that can be used to replenish soils, too much manure or improper handling of manure can pose risks to public health for the following reasons:

- **Pathogens:** Manure contains potential disease-causing bacteria, viruses, and parasites including *E.coli* 0157: H7, a number of *Camplylobacter* and *Salmonella* species, *Listeria monocytogenes*, *Helicobacter pylori*, and the protozoa *Cryptosporidium*. Improper handling of manure from ILOs may increase the potential transmission of disease. It is important to note that even proper handling of manure may still cause disease. In Walkerton, Ontario, the farmer who had spread manure on his field in the weeks prior to heavy rainfall in 2000 was found to have completely complied with safe manure-handling practices (O'Connor, 2002). This incident reflects the risk of improper water treatment where land applications of manure occur in close proximity to water sources.
- **Nitrogen and phosphorous:** Excess nitrogen and phosphorous from manure leeching into the soil or water can cause eutrophication and algae overgrowth of surface water. The blooms degrade water quality, and some algaes, such a cyanobacteria (blue-green algae), can create toxins harmful to human health (PHO, 2000b) and kill aquatic life.
- **Antibiotics and metal compounds:** Antibiotics and metal compounds, such as iron, arsenic, manganese, zinc, and other trace minerals are routinely added to animal feeds to promote growth and improve overall health. About 25 per cent to 75 per cent of the antibiotics in animal feed can pass into the manure unchanged where they can affect soil, water, and air quality, and potentially help foster the creation of antibiotic-resistant strains of microbes (Chee-Sanford, Aminov, Krupuc, Garigues-Jean, & Mackie, 2001).
- **Dust, moulds, and noxious gases:** Manure, when dry, can release irritating dust and mould spores into the air that are an irritant to airways, exacerbating bronchitis and asthma. Poultry farming contributes to poor air quality in the Fraser Valley. Volatile compounds from manures, such as ammonia and hydrogen sulfide, and other noxious odours can pollute the air and cause headaches and other health complaints. Hydrogen sulfide (noted by the rotten egg smell) produced by liquid manure can be a potent neurotoxin that causes persistent brain damage and can be deadly at higher levels, but there is controversy over the potential health effects at low levels (United States Environmental Protection Agency, 2003; Woodall, Smith, & Granville, 2005). The uncertainty over the impact of hydrogen sulfide produced by large-scale hog farms is part of the reason various health groups, such as the Canadian Medical Association, Canadian Public Health Association, and American Public Health Association, have called for moratoriums on large-scale farms until more scientific study can be conducted.

In BC, the Code of *Agricultural Practice for Waste Management* is part of the Agricultural Waste Control Regulation, which in turn is part of the *Waste Management Act*. The Code prescribes specifications for manure storage, handling, and application as fertilizer. The Code applies to all agricultural operations and has no specific references to intensive

"Extra Label" Drug Use

Using a drug in animals in a way that is not generally recognized or approved by the label or by Health Canada is called "Extra Label" Drug Use (ELDU), or off-label use. Veterinary doctors and others acknowledge they have used over-the-counter or prescription drugs meant for humans for decades as a way to save sick animals. In 2000, a European Union delegation audited Canada's control of veterinary drug use in the food supply and raised concerns about potential ELDU misuse, noting varying provincial standards and a lack of a national approach to the issue.

The public health concerns of ELDU are:

- Possible drug residues in food products that are not tested for nor regulated.
- Possible antimicrobial resistance.

Health Canada has initiated a steering committee to identify the gaps in ELDU controls and the impact on public health, and to examine and develop policy options. Initial issue identification reports are available at the Veterinary Drug Directorate at: http://www.hc-sc.gc.ca/vetdrugs-medsvet/eldu_e.html.

Fighting Resistance

Resistant strains of bacteria cannot be blamed solely on the use of antibiotics in animals. Inappropriate use in humans is equally problematic. The general public should do the following:

- Use antibiotics wisely—finish all prescriptions, do not demand antibiotics to treat viruses, and do not share prescriptions. Try watchful waiting for ear infections and other illnesses that could be viral.
- Do not use antibacterial soaps or cleaning products. In general, the use of antibacterial soaps or products offers no benefit when compared to plain soaps, and their use likely contributes to the emergence of antibiotic resistance.
- Avoid flushing antibacterial cleaning products or unused drugs down toilets or sinks where they can contaminate the environment.
- Wash hands regularly with plain soap.
- Follow safe food handling practices.
- To exert lobbying pressure on agriculture, consider supporting producers who avoid antibiotics or who are certified organic producers.

livestock operations. Key elements of the Code include establishing the required setback of manure storage and feeding operations from water courses or water supplies, the amount of time manure can be stored, and the conditions under which manure can be spread on fields. Livestock farmers who conform to the Code do not require a Waste Management Permit.

Antibiotics

Today, it is estimated that more than half of all antibiotics produced in North America are used in animals, not only to treat and prevent sickness, but also to promote growth. This practice of giving antibiotics to animals in absence of disease, common for more than 50 years, is considered a significant factor fuelling the growing drug-resistant strains of pathogens around the world.

In June 2000, the World Health Organization warned that the growing drug resistance of microbes threatened to reverse medical progress worldwide. In 2003, an international expert consultation convened by the Food and Agricultural Organization, Organization of International Epizootics, and the World Health Organization concluded that "there is clear evidence of adverse human health consequences due to resistant organisms resulting from non-human usage of antimicrobials" in Europe (Food and Agricultural Organization of the United Nations, Organization of International Epizootics, World Health Organization, 2003).

Studies are finding that resistant bacteria in meats can be transferred to humans. A 2001 study that sampled for *Salmonella* in ground beef, chicken, turkey, and pork purchased from retail stores in the United States found that of the 20 per cent that contained *Salmonella*, 84 per cent were resistant to at least one antibiotic and 53 per cent were resistant to three antibiotics. The authors concluded that resistant strains are common in retail ground meats and called for the adoption of guidelines for more prudent use of antibiotics in food animals (White et al., 2001). This study, along with others showing the relationship between animal use and growing resistance, led to a New England Journal of Medicine editorial calling for the ban of all non-therapeutic use of antimicrobials in animal feed (Gorbach, 2001).

In 1999, Health Canada established the Advisory Committee on Animal Uses of Antimicrobials and Impact on Resistance and Human Health. The advisory committee issued a final report in 2002 which reviewed the literature and made 38 recommendations, including restricting all animal use of antimicrobials to a prescription, improving surveillance of resistant strains, setting thresholds and benchmarks to measure resistance, as well as improving the evaluation of antimicrobial efficacy as growth promoters. Health Canada formulated a policy response to the report in 2003 through its Veterinary Drugs Directorate.

Progress in dealing with this issue in Canada has been slow, largely because of its controversial nature. In general, public health officials support much tighter restrictions and regulations, even bans, on the use of antimicrobials in animals. Many note that a greater focus on good hygiene and more space for animals could reduce the need for antibiotic use. The veterinary and agricultural sectors counter that the growing problem of resistance cannot be blamed solely on animal use and that

restricting the use in animals will lead to more animal disease, poorer quality meat, and higher costs for food. They claim it is better to prevent outbreaks by small doses of antibiotics than to have to treat animals with much larger doses once an infection has taken hold.

Gaps in information and scientific data have also hampered progress. One of the key recommendations in the Provincial Health Officer's report entitled *Antimicrobial resistance. A recommended action plan for British Columbia* (2000a) was to implement monitoring mechanisms for antimicrobial use in animals and humans, and to survey the prevalence and susceptibility of resistant organisms in agricultural settings and health care.

In 2003, the Canadian Integrated Program for Antimicrobial Resistance Surveillance (CIPARS) was created in collaboration with Health Canada, the Canadian Food Inspection Agency, and provincial partners. The surveillance program has been modeled after international surveillance programs, such as one in Denmark and one in the United States. Now under the auspices of the Public Health Agency of Canada, CIPARS is monitoring the trends in the development of antimicrobial resistance in the food chain. One of the key goals of CIPARS is to build a solid evidence base for developing overarching policies on antimicrobial use.

CIPARS has now released two reports, one in 2004 (reporting on 2002 trends), and the latest in March of 2005 (reporting on 2003 trends). Surveillance activities include collecting samples from the intestinal contents of animals at slaughter and testing samples of retail meat in Ontario and Quebec as an indirect measure of potential human exposure to resistance arising from the consumption of animal products.

The 2005 report found the following key results:

- Isolates of generic *E.coli* showed resistance to one or more antimicrobials in 88 per cent of swine, 84 per cent of chicken, and 34 per cent of cattle in abattoirs across Canada.
- With *Salmonella*, 41 per cent of isolates from chicken and 49 per cent from swine collected in abattoirs across Canada were resistant to one or more antimicrobials.
- A sample of 3056 clinical isolates from human *Salmonella* showed that a large number of strains were resistant to one or more of 16 antimicrobials.
- In retail samples, resistance was lower than in abattoirs; however, resistance to the drug ceftiofur in *E.coli* was found in 18 per cent of isolates from chickens in Ontario and 33 per cent of isolates from chickens in Quebec.
- For *campylobacter* in retail chicken, 72 per cent of isolates in Ontario and 79 per cent of isolates from Quebec were resistant to one or more antimicrobials. Of most concern was that around 4 per cent of isolates in both provinces were resistant to ciprofloxacin, one of the most important antibiotics in the current drug arsenal for treatment of human infections.

The 2005 report concluded that the findings create an important baseline, and that future results, including expanding retail samples to other provinces, will help inform future risk management decisions (Canadian Integrated Program for Antimicrobial Resistance Surveillance, 2005).

The Codex Alimentarius Commission

For more than 40 years, a joint body of the World Health Organization and the United Nations Food and Agriculture Organization has been setting international standards through the Codex Alimentarius Commission. The Commission has two main purposes: protecting consumer safety and establishing fair and standard practices to promote international food trade. Formed in 1963, the Commission's guidelines now cover all foods whether processed, semi-processed, or raw. The Commission provides approval standards for anything that might be in food, from how many bits of peel are tolerated in a tin of "whole peeled tomatoes", to the acceptable daily intakes for growth-promoting hormones in beef cattle.

In 1995, in a controversial decision, the Commission established Maximum Residue Limits (MRLs) for growth-promoting hormones—a decision that later became the basis for a complaint brought to the World Trade Organization by Canada and the United States regarding a European Union ban on beef treated with hormones. Canada and the United States successfully argued that the Commission's decision to set maximum residue limits signaled that the hormones were scientifically proven safe (Kimbrell, 2000).

In 2003, the Codex established 50 new standards, which included genetically modified organisms and irradiated food. The guidelines establish broad general principles to make the analysis and management of risks related to foods uniform across all of the Codex's 173 member countries. Provisions include pre-market safety evaluations, tests on potential allergies, and product tracing for recall purposes. For more information on the Codex, please refer to the Food and Agriculture Organization's website at http://www.fao.org.

Bovine Growth Hormone in Milk

Recombinant bovine somatotropin, also known as rBST, is a synthetic version of a naturally occurring growth hormone. Developed by a United States company, Monsanto, and approved for use in the United States in 1993, the hormone is given to cows by injection to stimulate increased milk production when lactation cycles are in decline. It boosts milk production in the average cow by 10 to 15 per cent. In 1999, Health Canada rejected use of the product in Canada not for any concern over risks to human health but because rBST is harmful to the health and wellness of dairy cows; it significantly increases the risk of mastitis, infertility, and lameness in cows. Human health is seen to be unaffected as up to 80 per cent of all rBST and BST (naturally produced in the pituitary glands of all cattle) is destroyed by pasteurization (Dohoo et al., 2003; Health Canada, 2005b; rbstfacts.org, n.d.).

In October 2005, a National Conference was held on Agriculture's Role in Managing Antimicrobial Resistance. The conference brought together federal, provincial, industry, and academic organizations from across Canada to review the surveillance data and progress to date, debate regulatory initiatives, and formulate actions in Canada towards prudent use of antimicrobials over the next five years.

Growth-promoting Hormones in Beef

Growth-promoting hormones have been used by Canada's beef industry for more than three decades. Hormonal growth promoters (HGPs) increase lean tissue growth and reduce fat deposition, enhancing food conversion efficiency because fat is so energy dense. HGPs can boost beef production by as much as 15 per cent, resulting in cheaper meat for consumers. Although many people believe that hormones are widely used in other meat and egg production, in Canada the use of growth hormones is permitted only in beef cattle. The use of growth hormones is currently prohibited in Canada's veal, pork, poultry, and egg industries (Health Canada, 2005b; Canadian Pork Council, 2005; Stephany, 2001).

Health Canada has approved six hormones for use in beef cattle. Three are naturally occurring hormones: progesterone, testosterone, and estradiol-17ß. The other three are synthetic hormones: trenbolone acetate, zeranol, and melengestrol acetate. All of the hormones are administered as subcutaneous implants (a pellet behind the ear) with the exception of melengestrol acetate, which is given as a feed additive. The implants are designed to deliver the hormones at a slow but constant rate (Health Canada, 2005b; United States Food and Drug Administration, 2002).

The scientific and public health communities in North America generally accept the use of HGPs in beef on the basis that existing scientific evidence does not show its residues pose an undue risk to human health. The Codex Alimentarius has established a maximum residue limit (MRL) for HGPs in beef, which is followed by Health Canada. The European Commission and European scientists, however, claim hormone-treated beef is potentially toxic and unsafe for human consumption.

A 1989 European Union ban on beef raised with hormones has been the focus of a protracted trade dispute that, at the time this report was written, was still not resolved. Despite a World Trade Organization (WTO) ruling in favour of the position that hormone-treated beef is safe for human consumption, and WTO-sanctioned retaliatory trade actions taken by Canada and the United States, the European Union maintains its ban on beef treated with hormones. At the centre of the European Union's concern is the natural hormone estradiol-17ß, and the debate whether it is a complete carcinogen that exerts both tumour-initiating and tumour-promoting effects. Some European scientists are concerned about the impact of estradiol-17ß on pre-pubertal children, who they believe may be particularly sensitive even to low doses (Andersson & Skakkebaek, 1999). The European Union also says there is inadequate data for a quantitative assessment of potential health hazards of the five other growth promoters, but maintains that pre-pubertal children are at the greatest risk from estradiol-17ß (European Union Food

and Feed Safety, 2005). Health Canada's Veterinary Drug Directorate reviewed the 17 studies commissioned by the European Union and concluded that residues in meat from animals treated with HGP, when administered according to good veterinary practices, do not pose undue risks (Health Canada, 2005b; International Trade Canada, 2005).

Bovine Spongiform Encephalopathy – Mad Cow Disease

The rise of Bovine Spongiform Encephalopathy (BSE), or mad cow disease, can be linked to the huge expansion in the scale of livestock farming. Before the advent of industrial farming, cattle raised for meat were fed on a diet of grass and hay. As farm operations grew larger, it became more efficient to move cattle to feedlots. BSE is thought to have emerged because farmers, who were looking for a cheap source of protein and a way of disposing of unmarketable cattle remains, used cattle feed augmented with protein rendered from the carcasses of other cattle (CFIA, 2005a). In essence, it was a form of bovine cannibalism in which ruminant herbivores were fed meat proteins from their own species. This practice has now been banned.

Bovine Spongiform Encephalopathy is a Transmissible Spongiform Encephalopathy (TSE), a group of rare fatal diseases linked to an infectious protein particle called a prion, short for "proteinaceous infectious particle." The prions attack the brain tissue and central nervous system of animals, including humans, forming spongy misshapen tissue. Prions and TSEs are emerging as potentially significant public health risks (Belay & Schonburger, 2005).

Bovine Spongiform Encephalopathy first became a public health concern when the disease emerged among cattle in the southern part of Britain in late-1986. An epidemic of BSE rapidly ensued, with a peak of more than 37,000 confirmed cases in the United Kingdom in 1992 and a total of more than 170,000 cases of BSE diagnosed by 1998. The source of the epidemic is believed to be cattle feed that included the rendered protein from sheep infected with a TSE called scrapie. Once the disease had been transmitted to cows, its spread was augmented by the addition of the dead carcasses of BSE-infected cows back into the rendering process.

Cows with BSE exhibit a number of different symptoms, including lack of coordination or difficulty standing up, nervous or aggressive behaviour, abnormal posture, decreased milk production, and weight loss. Milk, muscle, and blood from cattle infected with BSE have never been found to be infectious. Infectivity has been limited to the brain, spinal cord, and retina. The incubation period for BSE is about four to five years (Johnson & Gibbs, 1998; CFIA, 2005a).

Bovine Spongiform Encephalopathy and Variant Creutzfeldt-Jakob Disease

Creutzfeldt-Jakob Disease (CJD), a TSE that affects humans, is not linked to food consumption. In the past decade, however, a new form of CJD called variant Creutzfeldt-Jakob Disease (vCJD) has been diagnosed. Scientists believe it is linked to the consumption of meat products from cattle infected with Bovine Spongiform Encephalopathy (BSE). Overall, 149 people in the United Kingdom and France have died from vCJD. The only cases of vCJD

TSEs – Fatal Brain Diseases

Transmissable spongiform encephalopathies (TSEs) are all characterized by spongy deterioration of the brain. They are unusual in that they can be infectious and hereditary and also arise sporadically. They are all incurable and fatal. The TSEs include:

- **Scrapie** – known for more than 200 years to affect sheep and goats.
- **Chronic Wasting Disease (CWD)** – affects deer and elk.
- **Kuru** – is a rare and fatal brain disease among the cannibalistic Fore tribe of Papua New Guinea, who, in a funeral ritual, eat the brain tissue of the deceased.
- **Creutzfeldt-Jakob Disease (CJD)** – a dementia affecting humans that arises sporadically with about 0.5 to 1.5 cases per million population annually, most arising spontaneously and up to 15 per cent hereditary. Cases of CJD have been spread as a result of contaminated medical procedures and growth hormone. Eighty per cent of infected patients die within a year.

What is Rendering?

Rendering, which dates back to Egyptian times, converts animal carcasses into fats and proteins for other industrial uses. Bones, fat, gristle, tough membranes, hooves, hides, and horns comprise about 40 per cent of an average steer's weight and can quickly putrefy following slaughter. Renderers mince raw animal materials and boil them in vessels sealed under pressure. The mixture separates into fats on top and protein below and both find uses in a huge array of industrial products, including soap, cosmetics, gelatin, pet food, asphalt, and tires. Cattle feed began incorporating rendered fats in the 1960s and then, in the 1990s, rendered proteins were added to boost animal growth rates (Rampton & Stauber, 1997). BSE researchers believe this may be the origin of BSE in beef cattle, particularly in Britain.

Tracking Canadian Cattle

The Canadian Cattle Identification Program for cattle and bison was created in 2001 to trace individual animal movements from birth to slaughter. Farmers and ranchers apply ear tags to any cattle or bison leaving their farm or ranch. The information on the tags is registered in the CFIA's database. If a slaughtered cow tests positive for BSE, the inspection agency can trace its origins and try to uncover the source of the problem (CFIA, 2003a).

reported in Canada and the United States, along with one case in Japan, have been in people thought to have eaten infected beef during extended stays in the United Kingdom (FAO, 2005; CFIA, 2005b). No human cases of vCJD have originated in Canada or the United States from infected North American beef.

Bovine Spongiform Encephalopathy Record in Canada and Northwestern United States

Inspection agencies in both countries have detected BSE in a small number of cows, none of which entered the food or animal feed systems:

- The first case of BSE in Canada was found in 1993, in a beef cow imported from Britain.
- A second Canadian case of BSE was confirmed in May 2003. A Canadian Food Inspection Agency investigation determined that the infected animal consumed feed containing ruminant meat and bone meal that was produced before a 1997 feed ban, which introduced restrictions eliminating the use of rendered meat and bone meal from ruminants. Canada, unlike the United States, also bans the feeding of poultry litter and plate waste to ruminants.
- Canada's third case of BSE was confirmed in January 2005. Results of a feed component investigation were pending at the time this report was written.
- Two BSE cows have been found in Washington State: one in December 2003 and the second in June 2005. The first cow was born on an Alberta farm.
- Canada's fourth case was discovered in January 2006, and its fifth in April 2006. Since April 2006, three additional cases have been confirmed.

The existence of BSE cannot be confirmed in live animals. Symptoms of BSE can only be confirmed through testing of an animal's brain after death (CFIA, 2005a).

Canada has a number of safeguards in place to eliminate BSE and to ensure that any animals that contracted the disease before safeguards were in place do not enter the food or animal feed systems:

- Canada banned the importation of cattle from the United Kingdom and Ireland in 1990 and instituted a monitoring system for the remaining animals in Canada that had been imported from the United Kingdom since 1982.
- In 1990, Canada made BSE a reportable disease, meaning that any suspect BSE case must be reported to a federal veterinarian.
- In 1991, Canada banned beef products from other European countries with BSE cases.
- Canada's BSE surveillance program was created in 1992. The program tests the brains of high-risk cattle for BSE.
- In 1997, Canada banned the use of rendered protein products from ruminant animals (cattle, sheep, goats, bison, elk, and deer) in feed for other ruminants. A ban on materials from ruminant in all initial feed is under active consideration by the Canadian Food Inspection Agency and should be supported.

- Canada only allows the importation of live ruminants and their meat and meat products from countries considered to be free of BSE, and has additional import controls for animal products and by-products from countries where BSE has been confirmed.
- At-risk parts of slaughtered animals, including the brain and other central nervous system tissue, must be removed from cows slaughtered for human consumption in Canada (CFIA, 2005a).

Genetically Modified Organisms

Genetically modified organisms are organisms whose genetic material (DNA) has been altered by scientists as a way to introduce a potential advantage to either the consumer or the producer, or to both. Also known as genetic engineering or modern biotechnology, genetic modification of organisms involves manipulating their genes to incorporate a new trait, or to alter or silence an existing trait. For example, by introducing into corn the gene of a natural bacterium that attacks crop pests, corn crops can be raised without using an external pesticide. Soybeans that are genetically modified to tolerate applications of the herbicide Roundup offer producers a new tool for weed control. Dismantling a tomato gene related to ripening, in order to prolong shelf life, means that genetically modified tomatoes can ripen on the vine and obtain their full flavour without quickly spoiling on store shelves. Otherwise, tomatoes are often harvested while green and exposed to ethylene, a ripening hormone, during delivery (WHO, n.d; CFIA, 2001; Falk et al., 2002).

Genetic engineering is a promising field. In the food industry, it has the potential to make available products such as high-protein rice, high-iron milk, and high-vitamin A rice, all of which may contribute to solving global nutritional deficiencies. Genetic engineering may also help increase food security by making food production more efficient and reducing prices if genetically modified seeds result in larger yields per cultivated area. Innovations such as allowing cold tolerance to be bred into plants could increase food security by allowing people living in northern communities to grow more foods and therefore enjoy more fresh and less expensive produce with much greater nutrients (WHO, n.d).

Given the relative infancy of biotechnology, there is still much that we do not know about potential long-term impacts of genetically modified food on human health. The World Health Organization, while endorsing biotechnology as a means of improving human health and food security, points to a number of health issues of potential concern. In 2001, the Royal Society of Canada Expert Panel on the Future of Food Biotechnology, convened at the request of Health Canada, the Canadian Food Inspection Agency, and Environment Canada, also outlines issues of potential public health concern. These include:

- **Allergenicity:** The potential exists for food biotechnology to create new allergens or to transfer allergenic proteins into non-host foods. For some consumers, such as those allergic to peanuts, even trace amounts of an allergenic food may cause a severe reaction and potentially fatal anaphylactic shock. Genetically modified foods currently available to

Genetically Modified Foods in Canada

Genetically modified squash, tomatoes, potatoes, corn, soy, cotton, flax, canola, and wheat have all been approved for sale in Canada. Canola grown in Canada has been genetically modified for increased nutrition and pollination control, while the genetic make-up of corn, potatoes, and cotton has been altered to build insect or disease resistance. Corn, canola, soy, and cotton have all been changed to increase herbicide resistance. Three traits have been tinkered with in tomatoes to delay ripening. Health Canada approved the sale of the genetically modified Flavr SavrTM tomato in 1997 (Community Nutritionists Council of BC, 2001; Health Canada, 1997).

Transfer of Brazil Nut Allergen via Genetically Modified Organisms

The potential transfer of genes from foods that are common allergens is one of the areas of concern around genetically modified foods. When scientists conducted research aimed to improve the quality of soybean meal as an animal feed, they transferred genetic material coding for a storage protein from a Brazil nut to a soybean. Since the Brazil nut is known to cause anaphylaxis in some individuals, the soybeans were tested to see if the allergenic protein had been transferred. Research was discontinued when tests determined that the allergenic protein had been transferred to the soybean (CFIA, 2001).

Cloned Cows?

It is now possible to clone cows and other food animals. Cloning uses DNA from a single animal parent to create an offspring that is genetically identical to the parent. In the United States, although cloned cows exist, the US Food and Drug Administration has not yet approved the sale of milk or meat from cloned animals in the marketplace.

In Canada, foods produced from animals cloned using embryonic cells, such as embryo splitting and embryonic cell nuclear transfer, are not considered to pose food safety concerns and face no restrictions on marketing.

A new cloning method, however, does raise some food safety concerns. Some animals produced through somatic cell nuclear transfer (SCNT), the type of cloning that produced the famous sheep Dolly, have had significant health problems. According to Health Canada, further investigation is needed to determine the safety of food products from these animals and their offspring. Livestock cloned using SCNT are not permitted to enter Canada's food supply due to insufficient data to guide required pre-market safety assessments of food from these animals and their progeny (Health Canada, 2003a; Dairy industry looks askance, 2005).

BC consumers do not appear to have a significant potential for causing allergic reactions, but the risk for allergic reactions will increase as the volume and scope of genetically modified foods in the marketplace grows. For food-allergic individuals, genetically modified foods introduce another variable in deciding which foods are safe to consume (CFIA, 1998; WHO, n.d.; Community Nutritionists Council of BC, 2001).

- **Toxicity:** Much remains to be learned about changes in natural toxicants in genetically modified foods, such as oxalic acid in green potatoes and other vegetables. Potential adverse health effects could arise as a result of the over-expression of a toxicologically active constituent in genetically modified foods, such as an existing protein, meaning that humans could have greater exposure to the constituent than previously found in their diet. Genetically modified foods could also lead to a potential excess intake of nutrients, as iron-fortified milk could cause iron overload or exacerbate undiagnosed hemochromatosis, and a surfeit of vitamin A could increase the risk of birth defects (Royal Society of Canada, 2001; Community Nutritionists Council of BC, 2001).

- **Gene Transfer:** Antibiotic-resistant genes are commonly used to create genetically modified foods. The antibiotic-resistant genes are used as marker genes that are introduced along with DNA coding for the desired trait to allow confirmation that the transfer of genes has been successful. Health concerns relate to the potential transfer of these antibiotic-resistant genes from genetically modified foods to cells in the body or bacteria in the intestinal tract, particularly given the rise in drug-resistant bacteria and declining effectiveness of many antibiotics. Although the probability of such transfer is low, expert panels struck by the Food and Agriculture Organization of the World Health Organization, and three federal departments of the Canadian government, have both recommended the use of genetic modification technology without antibiotic-resistant genes. To keep this recommendation in perspective, the expert panel convened by Canada's three federal departments points out that the widespread use of antibiotics in animal feed, along with the indiscriminate use of antibiotics in human medicine, likely constitutes a far greater risk factor for the increase in antibiotic-resistant bacteria than genetic modification technology (WHO, n.d.; Royal Society of Canada, 2001).

- **Outcrossing:** If conventional crops or related species in the wild are exposed to genes from genetically modified plants, or conventional and genetically modified seeds are mixed, there could be an indirect effect on food safety and security. One example is when traces of a genetically modified maize strain approved only for feed use appeared in maize products for human consumption in the United States. One solution to thwart outcrossing is for countries to adopt strategies to minimize mixing, such as clearly separating fields between genetically modified crops and conventional crops (WHO, n.d.).

Labelling of Genetically Modified Foods

Labelling of genetically modified foods remains controversial, and different countries have adopted different rules. European Union countries require all prepackaged products containing genetically modified organisms to state on the label: "This product contains genetically modified organisms." Non-prepackaged genetically modified products displayed for sale in the European Union must contain the same statement either on the product or in connection with its display.

In Canada, as in the United States, mandatory labelling of genetically modified foods is not required if there is no documented safety risk to the product. Canadian consumers currently do not know if the tomato, corn, squash, or other food they eat has been genetically modified, or if the prepackaged crackers and other food they buy have been manufactured with genetically modified canola oil or other genetically modified ingredients. In 2004, the Standards Council of Canada adopted a voluntary standard for labelling of genetically modified foods that could lead to more labels on food ingredients and food items. Health Canada requires labelling of genetically modified foods only if there is a health or safety risk such as the presence of a common allergen (CFIA, 2004; European Union Food and Feed Safety, n.d.)

Labelling is an area of controversy. Those in favour of genetically modified organisms say labels might deter uninformed people from buying healthy and safe food, while those in favour of the labels say consumers have the right to know what they are buying.

The Way Forward on Genetically Modified Organisms

It is clear that food biotechnology has potential advantages to food production and public health, yet at the same time concerns exist on its proper use and potential unintentional ramifications. To overcome this dichotomy, Canada's expert panel on the future of food biotechnology has made a number of recommendations related to public health. The panel recommended that Canada apply the "precautionary principle" to the introduction of genetically modified foods. According to the precautionary principle, new technologies should not be presumed safe unless there is a reliable scientific basis to consider them safe. As such, the panel called for more rigorous testing of genetically modified foods and independent review of the test results, with increased public access to the test results (Royal Society of Canada, 2001).

Public Health Issues in Seafood and Aquaculture

Consumers are bombarded with confusing information about the safety of both farmed and wild fish. Although the health advantages of eating fish are well established, it can be difficult to sift through what are often contradictory messages about the benefits and risks of eating fish and other seafood. Ongoing publicity regarding the high levels of mercury present in tuna and swordfish, and persistent organic pollutants (POPs) found in both farmed and wild salmon, might prompt some people to choose to eliminate fish from their diet altogether. The worrisome decline in wild fish stocks, and heated public debate surrounding BC's

▶ Antibiotics on Salmon Farms

BC salmon farms, unlike many on-land factory farms, only use antibiotics therapeutically—to treat disease—and not as a preventive measure.

Four antibiotics are approved for use on Canadian salmon farms. In BC, the antibiotics must be prescribed by a veterinarian and are administered in fish meal. The total amount of antibiotics used on BC salmon farms fell to its lowest level in a decade in 2001, when approximately 175 grams of antibiotics were used for every ton of production. By 2003, due to increased disease outbreaks, that number had climbed to almost 350 grams of antibiotics for every ton of production, or a total of about 25 metric tons of antibiotics used on all BC salmon farms that year. The Canadian Food Inspection Agency regularly samples BC salmon to ensure that antibiotic residues fall within legal limits (Ministry of Agriculture and Lands, 2004c).

quick-growing salmon farming industry, make it even more challenging for consumers to select options that are healthy both for themselves and for the environment.

As with other public health issues, the risks and benefits of consuming fish must be considered in context. Experts generally agree that the beneficial health aspects of eating one or more servings of fish a week outweigh any potential health risks from exposure to contaminants. The Canadian Heart and Stroke Foundation, for its part, recommends that consumers eat two to three servings of fish each week as part of a nutritious diet. There is indirect evidence to support claims that the regular consumption of fish, particularly the omega-3 polyunsaturated fatty acids found in fish oils, play an integral role in cell membrane function and development of the brain and eyes (Ruxton, 2004; Harris, 2004). Omega-3 fatty acids are a member of the alpha-linolenic acid family. They are believed to prevent blood platelets from clotting and attaching to artery walls, reducing the risk of stroke and heart disease. Omega-3s are also thought to reduce levels of serum triglycerides that, along with cholesterol, increase the risk of heart disease. Some studies suggest that consuming at least one serving of omega-3-rich fish per week can reduce the risk of death from heart disease by 44 per cent (Heart and Stroke Foundation, 2004; Harris, 2004).

As many wild fish stocks decline, aquaculture is promoted as a viable means of supplying protein for balanced diets that promote good health. In BC, the aquaculture industry has expanded significantly during the past several decades. BC's aquaculture enterprises produce everything from scallops to geoducks, but salmon farming dominates the industry. Although aquaculture has been practiced in some countries for centuries, many of today's aquaculture operations are highly intensive and farms can contain up to one million fish. The vast majority of BC farmed salmon are Atlantic because they have better growth and survival rates than Pacific salmon, are more docile, and provide more flesh to meet market demand. Chinook salmon, native to the West Coast, are being farmed in increasing numbers, but Atlantic still comprise about 85 per cent of the BC salmon farming industry (Ministry of Agriculture and Lands, 2004a).

Aquaculture has a tremendous potential to provide large numbers of people with protein. Species such as tilapia and catfish as well as salmon are widely considered to be healthy food choices.

The main concerns about farmed salmon parallel the experience with intensive livestock operations discussed earlier in this chapter. The same conditions vis-a-vis waste, antibiotic use, overcrowding, and disease transmission can exist for improperly managed fish farm operations. In addition, large numbers of fish confined in open net ocean pens may be endangering wild stock by facilitating the rapid spread of sea lice and other diseases, or may harm other marine species when medications are added to salmon feed to combat sea lice and other health problems.

Other concerns include a fear that if Atlantic salmon escape from the pens, they could compromise the genetic integrity of Pacific salmon. There has been a significant drop in the number of escapes of Atlantic salmon in BC in recent years. Other concerns are that farming uses a high ratio of three kilograms of fish in salmon feed to produce one kilogram of farmed salmon, as well as the increase in use of new vaccines and medicines aimed at reducing disease in farmed salmon.

Critics of open pens say closed containment systems would remove the risk of transferring disease to wild stock, eliminate the potential for escapes, and ensure that other marine species are not affected by medications fed to farmed salmon or by fish waste discharged from open net pens. There is, however, a significant increase in energy requirements associated with land-based pens and waste still needs to be disposed of in an appropriate fashion.

Industrial Contaminants

One cause for concern, from a public health perspective, is the potential level of some contaminants that may be concentrated in both wild and farmed fish. Some contaminants tend to accumulate in the food chain, so species that are higher up—top predators—may have industrial chemicals concentrating in their flesh. The two most common and concerning contaminants in fish and seafood are mercury and persistent organic chlorides, such as polychlorinated

biphenyls (PCBs). In response, some of the fish and fish oil in salmon feed may be replaced with vegetarian alternatives to reduce the contamination of persistence organic compounds that might otherwise be present.

Mercury: Most fish contain trace amounts of mercury, but some types of fish have mercury levels that can lead to significant increases in mercury exposure if consumed frequently. Health Canada advises consumers to limit consumption of swordfish, shark, or fresh and frozen tuna to one meal a week due to potential mercury contamination. For young children, pregnant women, and women of childbearing age, the recommended limit is one meal per month. This restriction does not apply to canned tuna, which tends to come from smaller and shorter-lived species possessing lesser amounts of mercury.

Health Canada has set guidelines for maximum mercury content in commercial marine and freshwater fish at 0.5 parts per million (ppm). This limit is more stringent than many other countries including the United States, where the limit (for methyl mercury alone) is 1.0 ppm (CFIA, 2002). Canadian Food Inspection Agency has performed limited testing on commercial fish species in BC. Unfortunately, this data was not made available for publication in this report, such information is necessary and should be made available to the public. The US Department of Health and Human Services and US Environmental Protection Agency have tested and established guidelines for fish and shellfish consumption.* Most fish such as salmon (fresh or frozen), cod, sardine, trout, tuna (canned, light), halibut, and snapper contain between 0.014 to 0.118 traces of mercury ppm, which is significantly below the recommended 0.5 ppm level set by Canada. The highest levels of mercury have been detected in mackerel king, shark, swordfish, and tilefish (Gulf of Mexico). For more information on actual concentration in fish, please consult the US Department of Health and Human Services and US Environmental Protection Agency website at http://vm.cfsan.fda.gov/~frf/sea-mehg.html. For general information on safety of mercury and fish consumption, please contact the Canadian Food Inspection Agency website at http://www.inspection.gc.ca.

Polychlorinated biphenyls (PCBs): Polychlorinated biphenyls (PCBs) were once used widely as industrial coolants and in electrical transformers. Although they were banned in 1976, they still persist in the environment. Along with other organochlorine compounds such as DDT—once used extensively on crops to kill insects and banned in Canada in 1970—PCBs have been linked to an increased risk of cancer. Although both wild and farmed fish can carry contaminants, raw farmed salmon contain higher levels of organochlorine contaminants—including PCBs, dioxins, toxaphene, and dieldrin—than wild salmon. Notably, the source of the contamination was most likely from feed (Hites et al., 2004). Concentrations of contaminants were consistently higher in farmed salmon from Europe than in farmed salmon from the Americas. Individual levels of dioxins and PCBs found in the salmon tested fell well within Canada's health guidelines, and both the salmon farming industry and the federal and provincial governments maintain that eating farmed salmon is a healthy food option. Although farmed salmon are higher in contaminants than other protein sources such as beef, pork, chicken, and eggs, these other protein sources do not possess the known health advantages of salmon (Hites et al., 2004).

The level of contaminants found in many fish signals that precautions must be taken to ensure that fish and other seafood can continue to form part of a safe and healthy diet. Oceans are an important source of nutritious food and should not be the recipients of millions of tonnes of pollutants each year. Farmed fish make an increasingly vital contribution to the provision of protein for human consumption; yet we must ensure that fish farming practices do not pose risks to human health, the health of our oceans, lakes, and rivers, or to the health and regeneration of wild fish stocks and other marine species.

Steps to Ensure the Safety of the Food Supply

The food safety issues identified in this chapter are most effectively identified and managed using a risk-based assessment approach. An effective tool for managing food safety risks, which has gained international support, is the Hazard Analysis and Critical Control Points (HACCP) system. HACCP is a system of process analysis and control originally developed more than 30 years ago by the National

* *Limited Canadian data from CFIA on mercury levels exists but is not available for publication.*

Aeronautic and Space Administration (NASA) to safeguard food preparation for space flight. A critical control point is any point in the process where the loss of control could result in an unacceptable safety risk. The original HACCP framework developed by NASA contained a seven-step approach; however, the system has been widely adapted to reflect the needs and diversity of the food industry. The essential elements included in most HACCP programs are an analysis of the potential hazards and identification of the critical control points; the establishment of critical limits for each control point and actions to be taken when the limits are not met; and an audit to ensure ongoing compliance with the identified controls.

The HACCP approach is an improvement from reliance on random spot checks and random sampling of foods to look for contamination. The process of random inspection and sampling is reactive rather than preventive and can only respond when an actual food safety hazard is found. HACCP systems, instead, predict where a food safety hazard is most likely to occur and prevent it from occurring or provide warning when it might have occurred.

Most importantly, HACCP-based principles:

- Are based on sound science;
- Focus on identifying and controlling the critical food safety steps in an operation;
- Permit efficient and effective government and public health monitoring, through auditing how well a food operation (producer, processor, distributor, or retailer) is complying with their food safety requirements over a period of time rather than how well they are doing at one point in time on a given day;
- Place appropriate responsibility for ensuring day-to-day safety of the food supply on the food operation, while allowing the government and public health to more effectively oversee and regulate the process.

Given the food safety concerns raised in this chapter, HACCP-based programs set up a systematic system to oversee the conditions when food may become unsafe. Although they have gained acceptance in some areas, particularly for food processing operations engaged in international trade, HACCP-based control programs can be applied to the food system from farm-to-fork, and therefore should be widely adopted across the entire food spectrum.

Summary

- Foodborne diseases are very common, striking an estimated 2 million Canadians each year. While the majority of cases go unreported, at least 10,000 cases are reported in Canada each year from which approximately 30 people die.
- The most common causes of foodborne disease are bacterial, viral, or parasitic infections, toxins created by bacterial growth, or chemical contamination.
- Of the more than 40 pathogens linked to foodborne illness, the most common causes in BC are Norovirus, *Campylobacter*, *E.coli* 0157:H7, *Salmonella*, and the three bacteria associated with improper temperature storage of foods: *B. cereus*, *C. perfringens*, and *S. aureus*.
- Marine-based food poisonings are most commonly *Vibrio parahaemolyticus*, paralytic shellfish poisoning from red tide, and Scombroid, which is a buildup of histamines in spoiling fish.
- The majority of food safety risks can be avoided with safe food handling, which includes good personal hygiene, especially good handwashing, proper cooking and food storage, and avoidance of cross-contamination by keeping cooking surfaces and utensils clean.
- Intensive livestock operations (ILOs), which concentrate thousands of animals on a small plot of land, create potential health concerns through the amount of manure produced, the use of antibiotics to fight illness and promote growth, and the potential for disease transmission to take hold when so many animals are confined together.
- All manure, even small amounts, can carry the risks of disease. But large amounts of manure produced on ILOs, sometimes greater than 2,000 kilograms per hectare of land, can create additional problems in its

safe and effective removal. Manure poses risks to public health because it may carry pathogens like *E.coli* 0157: H7, *Campylobacter*, *Salmonella*, etc.; its nitrogen and phosphorus may leach into water causing algae blooms; it may contain antibiotics which promote the creation of antibiotic-resistant microbes in the soil; and it may cause dust, moulds, and noxious gases.

- Uncontrolled antibiotic use in livestock is a public health concern. More than 50 per cent of all antibiotics in North America are used in livestock and this use is considered a significant factor fuelling drug-resistant strains of bacteria worldwide.
- The Canadian Integrated Program for Antimicrobial Resistance Surveillance (CIPARS), under the Public Health Agency of Canada, has published two reports that create an important baseline. The 2005 report found evidence of increased resistance in isolates from meat samples: isolates of *E. coli* were found in 88 per cent of swine, and 84 per cent of samples were resistant to one or more antimicrobials. In samples from humans, a large number of strains of *Salmonella* were resistant to 1 or more of 16 antimicrobials.
- Contrary to public belief, only beef cattle are fed hormones to promote growth, and these hormones have been used for more than three decades. Six hormonal growth promoters (HGPs) are approved for use in cattle in Canada and the US.
- While the scientific and public health communities in North America generally accept HGPs, their use is controversial in Europe, where HGPs are banned. European scientists are particularly concerned about estradiol-17ß's potential impact on pre-pubertal children.
- Health Canada's Veterinary Drug Directorate conducted a scientific review of the European Union studies on this issue and concluded that residues in meat from animals treated with hormonal growth promoters, when administered according to good veterinary practices, pose no undue risk to human health. This conclusion is consistent with that reached by the US Food and Drug Administration.
- The feeding of rendered animal protein to cattle in their feed is one of the likely sources of mad cow disease, or bovine spongiform encephalopathy (BSE), particularly an outbreak in Britain in the 1980s. BSE, which has been linked to infectious protein particles called "prions," can arise spontaneously. This practice has since been banned in Britain.
- Eating the central nervous tissue of infected cattle such as brain, spinal cord, retina, or meat products containing neural tissues (as in mechanically recovered meats), has been implicated in the transmission of variant Creutzfeldt-Jakob Disease (vCJD) in humans.
- To date in Canada, eight cases of BSE have been detected in cattle, none of which have contaminated the food supply. No vCJD cases have arisen in Canada linked to Canadian beef, unlike Britain and France where 149 people have died from vCJD.
- Genetically modified organisms have the potential to make food more nutritious or food production more efficient or economical; however, they also pose potential risks. Concerns over the use of genetically modified organisms include the transfer of allergenic proteins to unrelated foods, augmentation of natural toxicities in foods, transfer of genes that confer antibiotic resistance, and outcrossing, which is the inadvertent mixing of genetically modified genes with wild related species.
- Unlike Europe, Canada does not require genetically modified foods to be labelled.
- Canada's expert panel on the future of food biotechnology recommended that Canada apply the "precautionary principle" to the introduction of genetically modified foods; this principle states that new technologies should not be presumed safe unless there is a reliable scientific basis to consider them safe. As such, the panel called for more rigorous testing of genetically modified foods.
- A diet that includes regular consumption of fish and seafood is considered to be very good for health. Consumption of certain species of fish has its concerns, particularly the potential concentrations of mercury and industrial pollutants, particularly PCBs, at the top of the fish food chain.

- The overfishing of the oceans and the intensive farming approach to fish aquaculture is a concern. An environmentally sound and sustainable aquaculture, along with well-managed ocean fisheries, is an essential part of food security, so that future generations of British Columbians will have access to this healthy food source.
- Potential risks in our food supply can often be predicted, prevented, and managed using a well-designed risk management approach. The Hazard Analysis and Critical Control Points (HACCP) approach first designed by NASA to keep food safe in space flight has now been widely adopted in the food industry. The HACCP approach is a sound public health approach to controlling risks in the food supply from farm-to-fork and should be widely supported.

Chapter 6: Food and the Aboriginal Population

The health status of Aboriginal people in the past few decades has improved significantly in several key respects. Yet BC's Aboriginal population continues to experience a higher incidence of poor health and a disproportionate rate of chronic diseases compared to other BC residents. In Chapter 1, we examined the role that diet and nutrition can play as a significant risk factor for common chronic diseases. The evidence for high rates of obesity and Type 2 diabetes in the Aboriginal population suggests the intricate relationship between diet and health merits special attention for this group.

Terminology

The use of appropriate terminology avoids confusion and misinformation when referring to specific indigenous populations. The federal *Constitution Act* recognizes three *Aboriginal* peoples: Indians, Inuit, and Métis. The word Aboriginal is defined as being in place "before the arrival of colonists," and acknowledges the existence of Aboriginal, Inuit, and Métis communities in British North America at the time of confederation.

While the term Indian continues to be a legal term used for legislative and statistical purposes, First Nations is now widely used. This term may refer to either individuals or to a land-based community. When applied to individuals, it may refer to either Status Indians or non-status people. Status Indians are those recognized by the federal government as being subject to provisions of the *Indian Act* and eligible for certain programs and services, while non-status Indians are not recognized under the *Indian Act*, either because they are unable to prove their status or have lost their status rights. Many Indian people in Canada, especially women, lost their Indian status through discriminatory practices in the past.

The *Inuit* (formerly referred to as Eskimo) live primarily in Nunavut, the Northwest Territories, and northern Labrador and Quebec. While not subject to the *Indian Act*, Inuit can be subject to regulation by federal legislation in ways similar to that act.

Métis people are of mixed First Nation and European ancestry, distinct from First Nations and Inuit peoples. While their cultural roots are in what became the three Prairie provinces, Métis live throughout Canada, including BC. Métis are neither subject to the *Indian Act*, nor are they eligible for programs provided to status First Nations.

According to the 2001 Canadian Census, 170,025 Aboriginal people lived in BC in 2001. Of these individuals, 118,290 were Status Indians, 44,270 were Métis, 805 were Inuit, and 6,660 were considered as other (BC Stats, 2001).

Availability of Data

Although there is considerable interest in the health status of all Aboriginal peoples (including Métis, non-status, and Inuit), in most cases, relevant data is only available for Status Indians. Information to identify Status Indian data in this report was obtained from the British Columbia Vital Statistics Agency, British Columbia Medical Services Plan, and the First Nations and Inuit Health Branch of Health Canada (British Columbia Vital Statistics Agency, 2004).

The Thrifty Gene Theory

Why are diabetes and obesity more prevalent in the Aboriginal population? The "thrifty gene hypothesis" suggests that some populations developed strong biological mechanisms for conserving energy as fat to enable their survival in times of periodic famine. Some researchers argue that the impact of the thrifty gene is particularly evident among Aboriginal populations who have made rapid social transitions from active hunter-gatherers to sedentary consumers. When the food supply is secure, the quick production of insulin can lead to health problems such as hyperglycemia, obesity, and diabetes (Young et al., 2000).

Health Outcomes in the Aboriginal Population

In the Canadian First Nations population, (particularly Status Indians, for whom data is available) obesity and Type 2 diabetes are considered major health problems, with over 50 per cent of this population having one of these conditions (Young, Reading, Elias, & O'Neil, 2000, as cited in Douketis, Paradis, Keller, & Martineau, 2005). This in turn impacts both a range of chronic conditions, as well as life expectancy. Most indigenous populations worldwide, including the Canadian Aboriginal population, share a pattern of premature morbidity. The key considerations are a long history of colonization, cultural deprivation, political impotence, and systematic discrimination, as well as genetics, lifestyle, socio-economic factors, poor quality housing and community environments, unemployment, and low levels of education. Some researchers have focused on the role of genetics as a risk factor for adverse health outcomes and suggest that in the Canadian Aboriginal population, the gene-environment interaction may be particularly strong. Others argue that socio-economic status, along with health-damaging behaviours such as smoking and the presence of two or more diseases together in an individual (co-morbidities), constitute health risk factors, rather than having an "Aboriginal" background itself (Cass, 2004).

Generally, Aboriginal communities experience significant and systemic inequalities, with resulting poorer health outcomes that cannot be accounted for by individual make-up or behaviour alone (Cass, 2004). Chronic diseases have complex origins and researchers are exploring the interplay of a range of factors leading to a greater burden of disease for Aboriginal populations. All risk factors are more prevalent and more severe in the general Aboriginal population. Initiatives that address the need to improve diet must work in concert with culturally appropriate, Aboriginal-led collaborative initiatives that address other risk behaviours like tobacco use, and the broader contextual issues of education, employment, and self-determination that accompany Aboriginal health issues.

Obesity and Diabetes in the Aboriginal Population

The epidemiological data on overweight and obesity for Aboriginal populations in North America is limited and generally focused on specific communities. Nevertheless, studies reveal high prevalence rates for obesity. One small study of adults in two Ojibwa communities, for instance, found a rate of obesity that was twice the current Canadian average (deGonzague, Receveur, Wedll, & Kuhnlein, as cited in Canadian Institute for Health Information [CIHI], 2004). Obesity has generally been linked to very high rates of chronic conditions, such as diabetes, hypertension, heart disease, and cancer. In fact, Type 2 diabetes has long been recognized as a serious health problem among many Aboriginal populations in North America, with indications of an emerging epidemic as early as the 1970s.

Diabetes in particular has been considered indicative of the rapid sociocultural changes experienced by Aboriginal people in the past several decades (Young et al., 2000). More recently, research is exploring the health implications of the radical shift from traditional diets to western diets, and from hunting-gathering to sedentary

consumption. Generally, risk factors for common chronic diseases are increasingly pointing to the role of diet and nutrition. The issue of "dietary acculturation," substituting modern for traditional food items, furthers the challenge of both understanding and improving Aboriginal health status. This is particularly the case, given the argument that many Aboriginal people consider the decline of hunting and fishing to be the underlying cause of the diabetes epidemic (Young et al., 2000).

Traditional Foods

The traditional foods of BC's Aboriginal population provided a diet high in protein, low in carbohydrates, and rich in essential minerals and vitamins (Kuhnlein & Chan, 2000). In coastal communities, dried herring eggs on kelp were a favourite snack, with the eggs providing protein, calcium, iron, and thiamine. Smoked salmon and salmon eggs made a common breakfast. Local plants supplied a fresh and diverse selection of fruits and vegetables, and nuts were often added to meat stock to make tasty and nutritious soups.

At the time of colonization by Europeans, approximately one-third of Canada's native population lived in BC. The abundance of seafood available year-round made it possible for coastal tribes to settle in permanent villages, often located along the shores of sheltered bays and inlets. When the Europeans arrived, some village sites had been occupied for more than 4,000 years (Indian Affairs and Northern Development Canada, 1996). Smaller numbers of Aboriginal people lived in BC's Interior. Those in the Northern (Subarctic) Interior spoke Athapaskan and lived a nomadic life of hunting and gathering. Southern Interior (Plateau) Aboriginals travelled around the region's dry grasslands and forests in the summer, seeking seasonal food, and settled into small villages of pithouses for the winter.

An estimated 90 per cent of the dietary protein of coastal Aboriginal people was derived from the ocean, but land animals and plants were also important sources of nutrition (Mos et al., 2004). Salmon, halibut, smelt, and herring were significant components of the traditional diet of most Aboriginal people, who relied on salmon runs on the Fraser River and its tributaries and throughout the Columbia River system. Wild game, such as deer, was another major source of protein, particularly in interior regions far from the ocean and

Provincial Health Officer's Report: Diabetes in the First Nations Population

The 2004 Provincial Health Officer's report, *The Impact of Diabetes on the Health and Well-being of People in British Columbia*, devoted a chapter to First Nations in British Columbia. The term First Nations is used since most data and information presented pertain to First Nations (in particular, those with Status for whom data is available). Some of the key findings were:

- The prevalence of diabetes among the First Nations population in Canada has increased significantly in the last 50 years (Health Canada, 2000).
- The combination of a western diet high in carbohydrates, simple sugars, and fats, and a sedentary, inactive lifestyle has more than likely contributed to the epidemic of diabetes among the First Nations population.
- At the end of fiscal year 2003/2004, there were an estimated 5,600 Status Indians living with diabetes in British Columbia.
- The prevalence of diabetes in the Status Indian population is higher among females in almost all age groups.
- The prevalence rate of diabetes among Status Indians is about 1.4 times higher than other BC residents.
- On average, each year, more than 100 Status Indians with diabetes die in British Columbia.
- Status Indians with diabetes accounted for 24 per cent of all circulatory system deaths, 17 per cent of all malignant neoplasm (cancer) deaths, and 17 per cent of all respiratory system deaths among the Status Indian population.
- When age-standardized to the overall population, the average health care cost per person with diabetes was $4,161 for Status Indians compared to $3,508 for other BC residents. The higher health care costs for Status Indians reflect their higher hospitalized co-morbidities and higher mortality.

The report made six recommendations specific to addressing diabetes in BC's Aboriginal population, including making healthy, affordable foods more available, supporting local food production, and reintroducing traditional diets. The report also reaffirmed five recommendations from the 2001 report, *The Health and Well-being of Aboriginal People in British Columbia*, particularly the need for improved standards of living, and more autonomy, recognition, and respect. For more information on either of these reports, please refer to the website at: http://www.healthservices.gov.bc.ca/pho/.

its buffet of seafood. Studies show that wild game is healthier than farmed animal food, which has a higher fat content. Compared with the farmed animals eaten today by most consumers, most wild game has about one-half the calorie content and is 50 per cent higher in other nutrients (Health and Welfare Canada, 1985).

A wide variety of fresh fruits and vegetables that are now known to be high in vitamins and minerals were integral to the traditional Aboriginal diets. Seaweeds were eaten fresh or dried for the winter by coastal peoples. Cooked dandelion greens supplied vitamins A and C, as well as calcium. Wild clover roots and silverweed roots, consumed by the Coastal Aboriginal population, were high in iron. Greens like fireweed and salmonberry sprouts supplied folic acid, vitamins A and C, and important minerals like iron, calcium, and magnesium. Altogether, 135 different kinds of plants were used as food, drinks, or for flavour in the traditional diet of BC's Aboriginals (Turner, 1978).

Many fats found in the traditional diet of BC's Aboriginal population came from fish, seeds, and nuts. These fats, which are known to help reduce blood cholesterol levels, were used to cook meats, fish, and vegetables; and to preserve food. Some traditional fats were a key source of fat-soluble vitamins (A, D, E, and K) and a source of essential fatty acids (Health and Welfare Canada, 1985).

Many plants also made a contribution to a balanced Aboriginal diet. The stalks of the rhubarb plant were eaten, but the leaves, which contain toxic amounts of oxalic acid, were avoided. Blue camas bulbs provided an important source of carbohydrates in the form of a complex sugar called inulin. Along with plants, fruits such as berries were also an important part of the traditional diet. In BC, there were more than a dozen varieties including salmonberries and wild strawberries, bog cranberries, thimbleberries, and salal berries. Berries were also used as a natural sweetener. All food was considered to be sacred, and ceremonies were often held to celebrate the ripening of different kinds of berries and other fruits.

Aboriginal people traditionally had their own healthy version of today's sweetened soft drinks. Using the stems, bark, or leaves of shrubs such as wild blackberry, they brewed beverages that were consumed for pleasure or to cure illness. Tea made from the Labrador bush, a scraggly shrub with dense clusters of white flowers, was popular throughout the province. The Sliammon prepared Labrador leaves by steaming them in a shallow pit, amidst layers of licorice fern rhizomes for flavouring, while the Haida drank Labrador tea as a medicine for sore throats and colds (Turner, 1975). Spruce bark, which has a plentiful supply of vitamin C, was boiled to make a tea that prevented scurvy.

Most food was only available seasonally, so food preservation techniques were used to ensure sufficient food in times of scarcity. Fish and game, such as deer, were smoked and dried for the lean winter months. Berries were poured into wooden frames set on skunk cabbage leaves, and placed near a fire to dry slowly for several days. Bulbs, roots, rhizomes, tree cambium, and seaweed were also cleaned and dried for winter. Dried black tree lichen contained a carbohydrate that swelled when mixed with liquid, giving those who ingested it the sensation of a full belly. The lichen, also used for thickening soups, was rich in iron and was a source of calcium as well (Health and Welfare Canada, 1985).

Collecting and storing enough food for survival was a time-consuming and challenging task. It demanded constant activity and kept the Aboriginal population physically active and fit. Men hunted and fished together. Women worked alongside each other digging edible roots and bulbs; cleaning fish and hanging them to dry in smokehouses; collecting shellfish such as clams, oysters, and mussels; and gathering berries in the summer and fall.

Change in Dietary Traditions

The first changes in the traditional Aboriginal diet began to occur soon after European contact. Refined sweeteners, like sugar and molasses, became readily available. Carbohydrates, such as potatoes, flour, rice, and beans, were instantly popular among Coastal and Interior Aboriginal groups. The consumption of traditional plant foods swiftly gave way to "white man's" fruits and vegetables (Turner, 1978). As industrialization and urbanization made commercial food more accessible, game meat was replaced by store-bought meat, natural foods by processed foods, and traditional beverages by pop, juice, and alcohol.

For millennia, Aboriginal people had been sustained by the diverse harvests of the nearby land, ocean, rivers, and lakes. Suddenly, over the course of a few decades, the traditional diet virtually vanished and a western diet was almost universally adopted. Instead of fresh, local fare, commercial foods produced elsewhere were consumed. Furthering the loss of the traditional diet, the establishment of residential schools separated children from their families and communities, hindering the custom of passing down traditional food knowledge from generation to generation. Other factors such as commercial traplines, unsustainable forestry, industrial pollution, and fish farming may have also contributed to the loss of the traditional diet. Lifestyles also became far more sedentary after Aboriginal reserves were established, contributing to an increased risk of obesity and associated chronic diseases.

The amount of carbohydrates consumed by BC's Aboriginal people was very limited prior to the introduction of sugar, potatoes, wheat, and other starchy foods. Following European contact, flour and sugar soon became prominent features in the Aboriginal diet, and were used in a variety of bread, cakes, and cookies. Today, market food comprises the bulk of Aboriginal diets. Across Canada, only about 15 per cent of Aboriginal people still obtain most of their animal proteins from hunting and fishing (Young et al., 2000). For the most part, nutrient-rich traditional plant foods are no longer gathered for barter or sale, although some people still collect them to share with friends and family (Turner, 1978). Many fish and shellfish, however, continue to represent an important source of nutrition and culture for BC's Aboriginal Peoples (Mos et al., 2004). One study of the Nuxalk Nation found that, with the exception of fish, very little traditional foods were still consumed (Hans, Hilland, & Kuhnlein, 2003).

Generally, the western diet embraced by a vast majority of BC's Aboriginal population today is far less healthy than a traditional diet since it represents an increase in calories, carbohydrates, total fat, and saturated fat intakes (Mos et al., 2004; Kuhnlein & Chan, 2000). It is also lower in nutrients than traditional food, and is thought by some researchers to have contributed to chronic diseases such as diabetes among Aboriginal people (Turner & Ommer, 2003). The combination of a western diet high in carbohydrates, simple sugars, and fats and a sedentary, inactive lifestyle has more than likely contributed to the epidemic of diabetes among the Aboriginal population.

Health Significance of Dietary Change

Researchers differ in their assessment of the relative importance of diet to health outcomes in the Aboriginal population. Some studies suggest diet is a pivotal factor. Research on communities of Pima Indians in the United States and Mexico, found a prevalence of diabetes in the former population despite their higher socio-economic status, and indicated the critical difference lay in the consumption of a western diet not available to their Mexican counterparts (Baschetti, 1997, 1999). Similarly, a group of Australian Aborigines virtually recovered from diabetes in five weeks by returning to their traditional diet (O'Dea, 1984), while a group of obese Hawaiians lost significant weight in three

Salmon and Crab

Traditional marine foods still play an important role in some Aboriginal communities in BC. A survey of the Sencoten (Saanich) First Nation suggests that traditional marine foods continue to make a valuable contribution to people's social and economic well-being, particularly in the case of older adults. Salmon, traditionally the most significant marine food, represented 42 per cent of marine meals among those surveyed. Crab was the second most consumed marine food. Adults over 40 were far more likely to eat traditional marine foods than younger generations (Mos et al., 2004).

Doctor Day, Food Boxes, and Community Kitchens in Aboriginal Communities

BC's five regional health authorities have made improving aboriginal health a priority. The Vancouver Island Health Authority is emphasizing nutrition and diet in the following programs:

- **Doctor Day** – a "traveling clinic" of health professionals visits the semi-remote Pacheedaht First Nation on the west coast of Vancouver Island on a monthly basis. The team includes a dietitian, a diabetes nurse, and a public health nurse, as well as an Aboriginal physician. The community nutritionist supports healthy eating for families, healthy eating on a limited income, and nutrition during pregnancy.
- **Food Box** is a collaborative of south island Aboriginal people. It provides reliable access to good, nutritious food by coordinating bulk purchase and delivery of healthy foods to individuals and families. More than 300 boxes are regularly delivered.
- **Meal Bag Program** provides a package of all ingredients for a nutritionally balanced meal to small groups of community members who gather to prepare and sample the meal and discuss preparation alternatives. This approach distributes appropriate foods and information as well as building individual capacity in a social setting.

No single program can suddenly change health status and outcomes, but these community initiatives are a step in the right direction.

weeks by consuming traditional foods to satiety (Shintani, Hughes, Beckham, & O'Connor, 1991).

Other researchers are more skeptical, arguing few dietary culprits for diabetes have been consistently identified and that concerns about nutritional deficiencies or diabetic precursors in western diets are still somewhat speculative. In this vein, a study of diabetic patients among the James Bay Cree, who spent three months in the bush living a traditional lifestyle, found the change did not lead to marked improvement in body weight, plasma glucose level, glycated hemoglobin concentration, and blood pressure. They were more physically active but they also bought large quantities of store-bought foods for sustenance, which likely negated the effect of increased activity (Young et al., 2000).

However, it is increasingly evident that effective primary and secondary prevention to address chronic disease in the Aboriginal population should place stronger emphasis on diet and should do so at critical stages of life.

Socio-Economic Status and Access to Food

Aboriginal people living in BC generally experience a standard of living that is 20 per cent below the provincial average, based on measures such as income, employment, educational attainment, and housing adequacy (PHO, 2002). Child poverty is of particular concern because of its association with a variety of poor outcomes later in life. Forty-one per cent of Aboriginal children live in families with incomes under $20,000, compared to 17 per cent for other BC children (PHO, 2002).

Canadian and other data generally indicate that low social status and living in poverty increases the risk of obesity and is associated with a 58 per cent increase in chronic conditions (Cass, 2004). However, evidence in BC suggests a region's health status is not always clearly linked to socioeconomic conditions. The 2001 Provincial Health Officer's Annual Report entitled *The Health and Well-being of Aboriginal People in British Columbia*, noted that areas of lower socio-economic status for Aboriginal communities, such as the Northern and Interior regions, had the best Aboriginal health status. These were the regions where formal health services were also least available. The research cited in the report suggested health outlooks were favourably influenced by the degree of social, cultural, and political integrity in those communities. It is evident that improving access to traditional diets will be one way to strengthen community integrity.

Enhancing physical and economic access to sufficient, safe, and nutritious food to meet dietary and food preference needs is an essential determinant of good health for the Aboriginal population.

Aboriginal groups clearly experience a disproportionate level of food insecurity due to poverty. Many people living on low incomes are unable to afford sufficient or nutritious food. Those living on remote reserves also face additional challenges in obtaining fresh and healthy food that must be transported long distances. Refrigeration and freezer storage mean that a variety of perishable foods are far more accessible than in the past, but, at the same time, for many, access to traditional foods has been reduced (Health and Welfare Canada, 1985).

As detailed in Chapter 4, food insecurity is a precursor to many health problems including malnutrition, low birth weight babies, unhealthy pregnancies, sub-optimal child development, poorer health in seniors, and greater rates of chronic disease. A disproportionate amount of calories are consumed as junk food because processed food is generally cheaper and more readily available than healthier foods like fruits and vegetables.

Some programs have been initiated by BC's health authorities to provide remote communities with increased access to low-cost, healthy food as well as dietary information and education. Such programs require further support and coordination.

Evaluating the link between ethnicity, culture, socio-economic status, and health is a difficult research challenge. Awareness of the broader determinants of health can play a role in developing effective interventions to change diet and physical activity patterns for specific populations. These interventions must go beyond the assumption that risk for chronic disease resides principally in the individual and his or her behaviour. They must involve integrated, multidisciplinary, and comprehensive approaches that work at the individual, community, environmental, and policy levels. In addition, they must build in respect for and sensitivity to language and cultural issues (Young et al., 2000; Cass, 2004). The Provincial Health Officer's 2001 report used not only health status indicators to measure Aboriginal health progress, but also indicators to measure other factors affecting health, such as high school completion rate, unemployment rate, low-income rate, and community control (PHO, 2002).

Food Safety and the Aboriginal Population

Across Canada, only 15 per cent of Aboriginal people still obtain most of their animal proteins from hunting and fishing (Young et al., 2000). For the most part, nutrient-rich traditional plant foods are no longer gathered for barter or sale, although some Aboriginal people still collect them to share with friends and family (Turner, 1978). Fish, shellfish, and game, however, continue to represent an important source of nutrition and culture for BC's Aboriginal population (Mos et al., 2004), and these types of foods can pose health risks from potential contamination from natural or man-made sources.

Red Tides

Red tides, or harmful algae blooms (HABs), remain of particular concern to local Aboriginal people who continue to harvest shellfish as part of their traditional heritage. The tides are caused by a species of algae called *Alexandrium*, a dinoflagellate microalgea food source for many filter-feeding shellfish. The algae produces a biotoxin (saxitoxin) that can be fatal to humans who eat the affected shellfish. Known as paralytic shellfish poisoning (PSP), this nervous system disease produces symptoms that usually start with tingling and numbness. The toxin interferes with nerve function, causing temporary paralysis, and can result in death through asphyxiation. The absence of red tide does not necessarily mean HABs are not in the water; in certain circumstances the algae may be present in the water without the red appearance. Conversely, other algae may produce a red pigment, but not contain toxin. Some species of shellfish that have accumulated toxin remain unsafe for consumption for up to one year after exposure to the toxin. To find out if an area is open for shellfish harvesting, contact the Department of Fisheries and Oceans (DFO) toll free at 1-866-431-3474, or visit their website at http://www.pac.dfo-mpo.gc.ca.

Measures have been taken to reduce the risk of paralytic shellfish poisoning along BC's remote central and north coasts. Many of BC's coastal Aboriginal people, in partnership with the Canadian Food Inspection Agency's (CFIA) Marine Toxin Monitoring Program, run their own PSP-monitoring programs. The Heiltsuk Nation, on the central coast, manages its own intertidal shellfish fishery. Harvests take place during months when there is a low likelihood of harmful algae blooms. The Nisga'a Nation has also worked with the CFIA to reduce risks associated with toxic algae blooms. The Nisga'a have designated beaches central to their food, social, and ceremonial shellfish harvests. The CFIA plan to set up monitoring stations on these beaches to help the Nisga'a determine safe periods for shellfish harvesting (Northwest Fisheries Science Center and Washington Sea Grant Program, 2002).

Other harmful toxins monitored jointly by the CFIA and Aboriginal people through the shellfish program include diarrhetic shellfish poisoning caused by several toxins, and amnesic shellfish poisoning (ASP), caused by the toxin

Botulism in BC

In August 2001, two separate botulism outbreaks involving Aboriginal communities occurred in northwestern BC. Both were related to fermented salmon roe, a delicacy of Aboriginal people on the west coast. One outbreak resulted in the death of a 73-year-old woman.

Botulism can begin with typical symptoms of food poisoning such as vomiting and nausea. It can quickly progress to include blurred vision, slurred speech, and muscle weakness. In some cases, it can leave victims completely paralyzed (Public Health Agency of Canada, 2002).

Contaminated Foods

Ooligan grease and white sturgeon are among the traditional foods found to contain persistent organic pollutants (POPs). Ooligan grease from BC's north coast and rivers was found to be contaminated with chlordane, chlorobenzene, DDT, dieldrin, HCH, mirex, and PCBs. White sturgeon in the Upper Fraser River were found to contain dioxin, furans, PCBs, and other contaminants (Kuhnlein & Chan, 2000).

domoic acid, produced by a species of diatom in the *Nitzia* family *(Pseudonitzia)*. The first reported outbreak of ASP occurred in Canada in 1987, when over 100 people reported illness and 4 deaths occurred. Symptoms of ASP are similar to PSP and may also include nausea and vomiting within 24 hours, and loss of short-term memory. (Brett, 2003; Isbister & Kiernan, 2005).

Industrial Pollutants

Another challenge to traditional food sources is the increasing incidence of industrial contamination. Many traditional marine food sources are now contaminated with persistent organic pollutants such as methylmercury and polychlorinated biphenyls (PCBs). From a public health perspective, it is sometimes necessary to close fisheries temporarily or even permanently because of potential risks posed by consuming contaminated food. Long-term exposure to mercury, for instance, can cause permanent damage to the brain and kidneys, and for pregnant women, can cause damage to the developing fetus (Chan & Receveur, 2000). The health impacts of PCBs and other organochlorines are not fully understood, but in children they have been linked to developmental delays, endocrine disruption, and neurobehavioral deficits (Kuhnlein & Chan, 2000).

In 1988, crab, prawn, and shrimp industries along the BC coast were closed due to high levels of dioxins and furans thought to originate from nearby pulp mills. Significant numbers of Aboriginal people who regularly consumed shellfish were affected, and the closure of Aboriginal fisheries brought about further changes in harvesting and consumption patterns (Wiseman & Gobas, 2002). Additionally, human health advisories were issued for the consumption of shellfish organ meats and certain fish. While every effort must be made to reduce the discharges that contribute to food contamination, with some exception, the benefits of consuming a traditional diet outweigh any risk.

Botulism

Foodborne botulism is a rare, but potentially deadly, paralytic disease that disproportionately affects Canada's Aboriginal and Inuit peoples. The most frequent sources are home-prepared products like canned foods, fermented Inuit food, and improperly stored marine meat (Weir, 2001). *C. botulinum* is an anaerobic, spore-forming bacilli commonly found in soil. As its spores reproduce, they generate one of the most potent lethal substances known: a single teaspoon can kill 100,000 people (MOHS, 2002). One case alone of foodborne botulism constitutes a public health emergency, as it may signal the beginning of a larger outbreak.

From 1971 to 1984, a total of 122 cases of foodborne botulism were recorded in Canada, mostly in northern Quebec, the Northwest Territories, and British Columbia. Twenty-one cases were fatal. The majority of the victims were native people and, of those, most were Inuit. About 60 per cent of the outbreaks were caused by raw, parboiled, or "fermented" marine animal meats, while fermented salmon eggs or fish accounted for 23 per cent of the outbreaks (Hauschild & Gauvreau, 1985).

Botulism can be avoided by canning seafood, meats, and vegetables at high temperatures in pressure canners (MOHS, 2002). The BC Centre for Disease Control does not recommend the consumption of fermented salmon roe due to potential health risks. Recognizing that "stink eggs" are a traditional Aboriginal food, however, the centre suggests that the risk of botulism be reduced by using alternative methods of fermenting salmon eggs, such as curing or sun-drying.

Micro-organisms in Game

The parasite *trichinella*, which in the past was most commonly associated with undercooked pork, is now almost exclusively found in wild meats, particularly bear, wolf, and artic marine mammals. In BC, bear is the most common source of the infection, trichinosis, and it is most common among Aboriginal people. In 2005, 27 cases of trichinosis were diagnosed in BC, primarily from eating bear meat (McIntyre et al., 2006).

Recently, wild deer have been found to carry a variant of spongiform encephalopathy, similar to mad cow disease, which theoretically can transmit the infectious agent, called a prion, to humans who eat brain, spinal cord, retinal material, and ground meat containing bits of central nervous system tissue. To date no known transmission from deer to humans has been recorded.

The potential for food safety risks in traditional Aboriginal diets requires supporting access to traditional food, and community capacity building in partnerships with scientific and health organizations, to ensure the safe use of traditional foods, particularly in regard to red tide, botulism, other microbial contaminants, and industrial pollutants.

Impact of Chronic Disease

The prevalence of heart disease, diabetes, and other chronic diseases are much higher in the Aboriginal population compared to other BC residents. A combination of a diet high in carbohydrates, simple sugars, and fats, and a sedentary, inactive lifestyle has more than likely contributed to the epidemic of chronic disease. Given the higher rates of disease among Aboriginal people, the need to address prevention and disease management clearly depends on understanding the particular challenges such as poverty and food security facing the Aboriginal population.

The prevalence of diabetes among the First Nations population in Canada has increased significantly in the last 50 years (Health Canada, 2000). At the end of the fiscal year 2003/2004, there were an estimated 5,600 Status Indians (a proportion of First nations for whom data is available) living with diabetes in British Columbia. Status Indian prevalence rates are approximately 40 per cent higher than those for other BC residents. The gap between Status Indian females and other BC resident females is substantially larger than for males. (Figure 6.1)

As can be seen in Figure 6.2, the age-standardized mortality rates for cancer, diabetes, and circulatory system diseases for Status Indians is significantly higher than the rates for other BC residents.[1] The Status Indian population also has much higher potential of life years lost due to the aforementioned chronic diseases compared to other BC residents (Figure 6.3). The potential of life years lost are the number of years of life lost when a person dies before a specified age (in this case 75 years).

Compared to other British Columbians, Status Indians are three times as likely to be admitted to hospital for conditions that could be managed in the community (Figure 6.4). These conditions include diabetes, asthma, hypertension, neurosis, depression, or abuse of alcohol and other drugs (PHO, 2002).

The higher mortality and morbidity rates for BC's Aboriginal population are not reflected in their use of primary care services. This suggests that present primary care for Aboriginal people may be lacking, culturally inappropriate, inaccessible, or in other ways less than optimal. For this reason in 2001, the Provincial Health Officer called for greater Aboriginal involvement in the design, delivery, and governance of primary and community-based care (PHO, 2002).

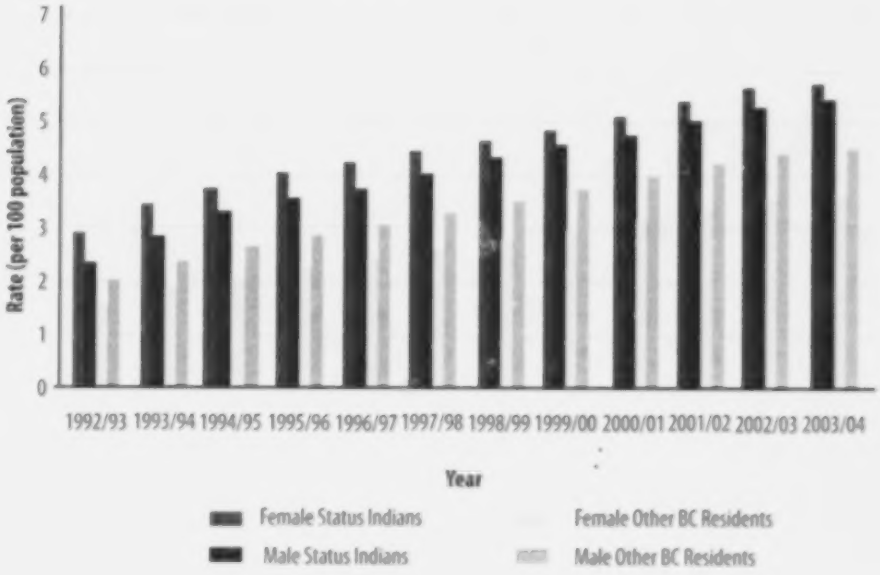
Appropriate public health interventions can help prevent chronic disease. Research suggests effective primary and secondary interventions to address chronic disease risk factors should be directed at critical stages of life. This includes targeting children and youth, given the evidence of significant challenges for diet, nutrition, and chronic disease in this age group.

[1] *For a more detailed explanation and calculation of this and other figures please see Appendix A.*

Figure 6.1

Age-Standardized Prevalence Rates for Diabetes, Status Indians and Other BC Residents, BC, 1992/1993 to 2003/2004*

In 2003/2004, the age-standardized diabetes prevalence rate was 5.6 per cent for males and 5.9 per cent for females in the Status Indian population. For other BC residents, the prevalence rate was 4.7 per cent for males and 3.8 per cent for females. The gap between Status Indian females and other BC resident females is substantially larger than for males (Figure 6.1).



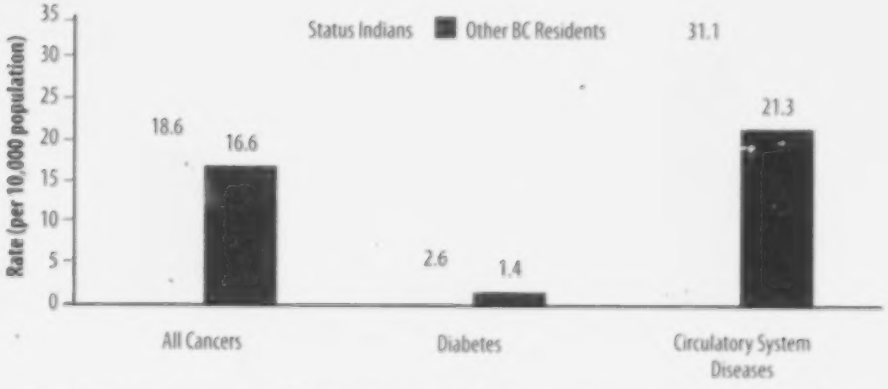
*Cases for 2003/2004 are adjusted to compensate for incomplete follow-up (12 months) of MSP component of the incident case definition. Trends for all populations are statistically significant ($p < 0.001$).

Source: Population Health Surveillance and Epidemiology, Ministry of Health, 2005.

Figure 6.2

Age-Standardized Mortality Rates for All Cancers, Diabetes, and Circulatory System Diseases,* Status Indians and Other BC Residents, BC, 2002

The age-standardized mortality rates for cancer, diabetes, and circulatory system diseases for Status Indians is significantly higher than the rates for other BC residents (Figure 6.2).

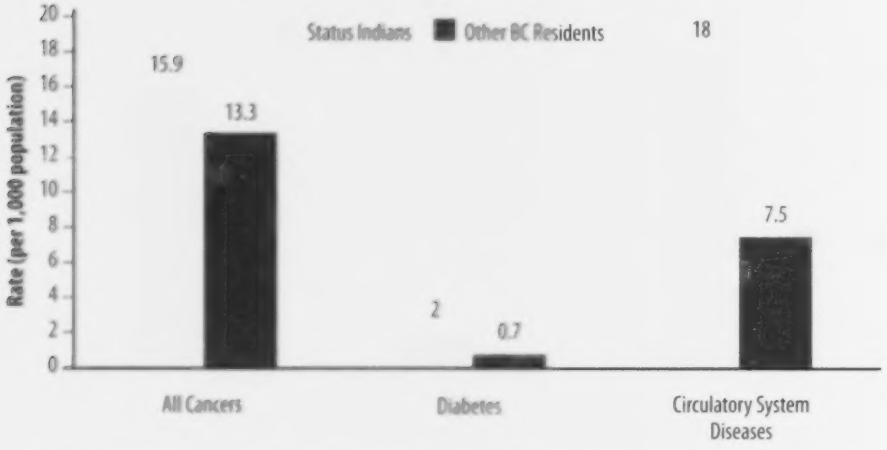


* Circulatory system diseases include ischemic heart disease, cerebrovascular disease, and diseases of the arteries.

Source: BC Vital Statistics Agency, 2004

Figure 6.3

Potential Years of Life Lost (Age Under 75 Years) for All Cancers, Diabetes, and Circulatory System Diseases,* Status Indians and Other BC Residents, BC, 2002



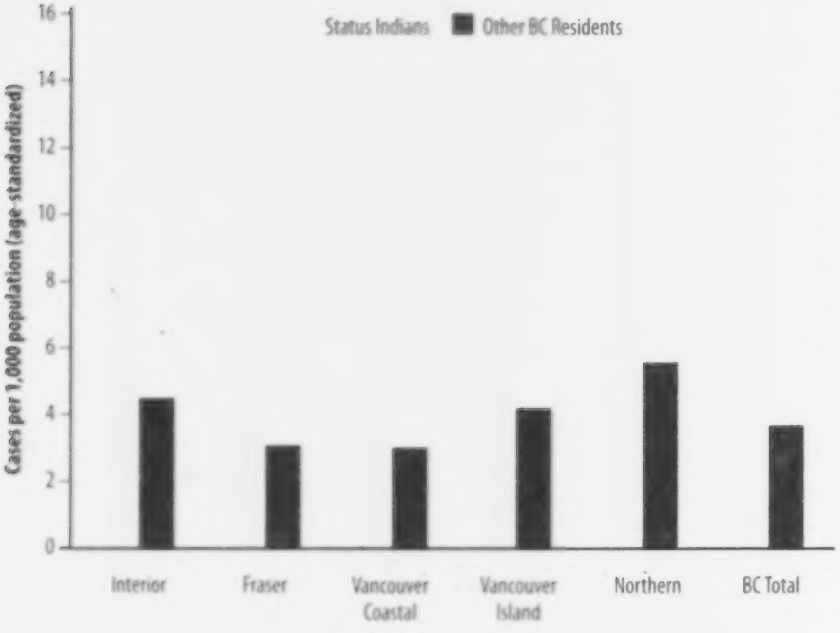
* Circulatory system diseases include ischemic heart disease, cerebrovascular disease, and diseases of the arteries.

Source: BC Vital Statistics Agency, 2004

The Status Indian population also has much higher potential of life years lost due to chronic diseases compared to other BC residents (Figure 6.3). The potential of life years lost are the number of years of life lost when a person dies before a specified age (in this case 75 years) (Figure 6.3).

Preventable Admissions to Hospital, BC, 2000/2001

Figure 6.4



Note: Acute care hospitalizations (cases) with a primary diagnosis of diabetes, alcohol and drug-related conditions, neurosis, depression, hypertension, or asthma.

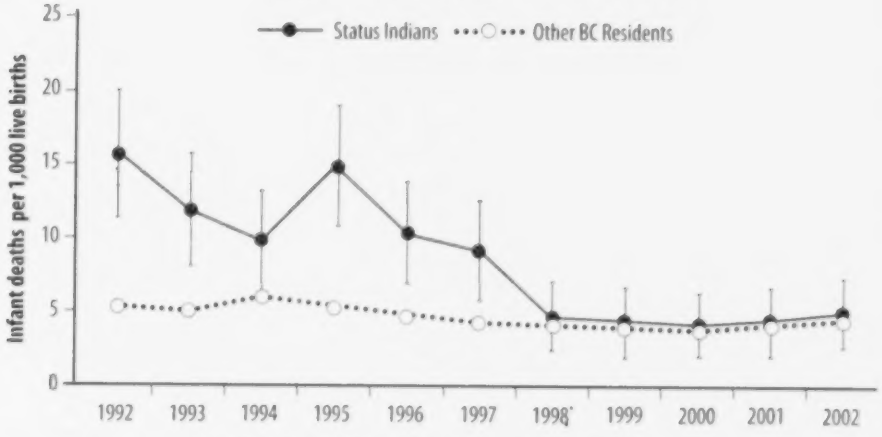
Source: Morbidity Database. Unpublished tables prepared by Information Support, BC Ministry of Health, project 2001-288.

Status Indians are three times as likely to be admitted to hospitals for conditions that could be managed in the community. These conditions include: diabetes, asthma, hypertension, neurosis, depression, or abuse of alcohol and other drugs (Figure 6.4).

Figure 6.5

In 2002, just 5 deaths occurred per 1,000 live births in the Status Indian population, approaching the 4 per 1,000 births in the BC resident population (Figure 6.5).

Infant Mortality Rates
Status Indians and Other BC Residents, 1992 to 2002



Note: Status Indian rate with 95% confidence interval.
Source: BC Vital Statistics Agency, 2004

Peri-natal Health Challenges

Infant Mortality Rates

BC's Status Indian population has had significantly higher rates of infant mortality and sudden infant death syndrome than other BC residents. In the 1950s, 1 in every 10 Status Indian babies died during the first year of life—5 times the provincial average. The gap between Status Indian infants and other BC residents has been steadily narrowing. Maternal diet during pregnancy impacts fetal health outcomes, which points to the fact that food security and access to nutritious food is essential in reducing the risk of infant mortality and improving the health of both the mother and the child.

Breastfeeding Rates

Rates of breastfeeding among Canada's Aboriginal population are lower than the Canadian average. Only 50 per cent of Aboriginal mothers breastfeed their babies, compared with a national average of 75 per cent (National Aboriginal Health Organization, 2004). Breastfeeding provides essential nutrients for optimal infant growth and development, as well as antibodies that protect against infection and allergies.

Infant Anemia

In Canada, 4 to 5 per cent of non-Aboriginal preschool children suffer from iron deficiency anemia, compared with between 14 and 24 per cent of Aboriginal and Inuit infants and children. This increases the risk for psychomotor impairment. The transfer of iron from mother to fetus largely occurs during the last trimester of gestation; the amount of iron present at birth depends on the length of the gestational period and the weight of the baby. "Iron stores

are generally depleted by 6 months of age, yet from 4 to 12 months after birth the infant's blood volume doubles. Thus, at this age, dietary sources of iron become critical to keep up with this rapid rate of red blood cell synthesis" (Zlotkin, 2003, p. 59).

Child and Youth Health Challenges

Pediatric Type 2 diabetes is a relatively new illness, and one that is on the rise in the Aboriginal population. Some of the first cases of childhood Type 2 diabetes were observed in Aboriginal communities, as well as some of the highest prevalence rates (Fearn, 2006). Although sometimes called "adult-onset" diabetes, Type 2 diabetes has been diagnosed in Canadian children as young as five. One study found that Aboriginal youth in Canada suffer from Type 2 diabetes at seven times the rate of other Canadian children (Campbell, 2002).

Similarly, small studies examining specific communities indicate the rate of overweight in Canadian Aboriginal preschool and grade-school children is high, generally standing at 27.7 per cent for boys and 33.7 per cent for girls, and is much higher in particular communities (Hanley et al., 2000).[2] However, researchers argue about the validity of this approach, since the growth pattern of many indigenous populations worldwide has not been studied. Similarly, researchers have suggested that more research is required to determine if body mass index and waist circumference cutoffs used for the general population are appropriate for Aboriginal populations (Ball & Willows, 2005).

Addressing Food in the Aboriginal Context

Effective primary and secondary prevention to address risk factors for chronic disease in the Aboriginal population should include a stronger emphasis on diet in a multifaceted program of initiatives, and should do so at critical stages of life. Food-related recommendations made in the 2004 Provincial Health Officer's Report on diabetes are equally relevant here and are reaffirmed:

- Aboriginal communities should be supported in ensuring that healthy and affordable foods are available.
- The possibilities of local food production should be considered.
- Communities interested in a reintroduction of traditional diets or their equivalent should be supported.

Summary

- The reasons for higher rates of premature morbidity and mortality among Aboriginal populations are a source of debate, but systemic inequities are usually seen as the most common reason.
- The prevalence of diabetes among Status Indians is 1.4 times higher than other BC residents.
- The traditional diet of the Aboriginal population in BC was high in protein, rich in fruits and vegetables, devoid of refined carbohydrates and starchy carbohydrates, and rich in essential minerals and vitamins. Multiple varieties of fish and seafood, berries, plants, and wild game were consumed. In addition, food collection and preparation were physically demanding, which helped keep Aboriginal people physically fit.
- Following contact with Europeans, the traditional Aboriginal diet rapidly changed to include much more refined and starchy carbohydrates like flour, potatoes, rice, beans, and simple sugars. Residential schools further hindered the passing of traditional knowledge around diet. Today the majority of Aboriginals follow a western diet that is higher in calories, refined carbohydrates, and total fat over the traditional Aboriginal diet.
- While controversial, changes in diet may be one of the most important factors underlying the higher rates of premature morbidity and mortality among the Aboriginal population.
- Returning to the traditional diet may be an important step to improve the health of BC's Aboriginal population. However, potential food safety concerns with the traditional diet, including red tide (paralytic shellfish poisoning) in seafood, industrial pollutants such as persistent organic chlorides and mercury in seafood, and botulism need to be recognized.

[2] *The study results were based on the height and weight measurement of 445 children and adolescents aged 2 to 19, and an assessment of fitness level, television viewing, body image concepts, and dietary intake of 242 subjects aged 10 to 19.*

Food and the Aboriginal Population

- Aboriginal people in BC have a standard of living that is 20 per cent lower than other British Columbians; this makes poverty and food security a persistent concern in this population. The Aboriginal population, due to low income or remote location on reserves, can have a difficult time obtaining access to healthy food.
- BC's Status Indian population has higher rates of preventable hospitalization compared to other BC residents.
- Aboriginal infants and children have greater health challenges with diet and food, and this may be linked to inadequate maternal nutrition. Iron deficiency anemia is more common and breastfeeding rates are lower than for other Canadians. Pediatric Type 2 diabetes is seven times higher in Aboriginal youth than in other Canadian children.
- Effective primary and secondary prevention to address risk factors for chronic disease in the Aboriginal population should include a stronger emphasis on diet in a multifaceted program of initiatives and should do so at critical stages of life.

Chapter 7: Recommendations

This chapter will outline some of the major findings in this report, point to some of the potential solutions, and make recommendations for actions for individuals, communities, businesses, and governments. In addition, it will outline some of the knowledge and research gaps and make recommendations for further research and evaluation.

Most British Columbians have physical and economic access to sufficient, safe, and nutritious foods to meet their dietary needs and preferences, and are able to have an active and healthy lifestyle. However at the provincial level, our food security, like that of most nations, is dependent upon a complex and potentially fragile web of production and distribution. If British Columbians were forced to fall back upon their own resources they could supply at most 50 per cent of their food needs (Smart Growth BC, 2004). In the event of a major catastrophe, most BC communities have less than 72 hours worth of food on hand (Barbolet et al., 2005; Institute for Social Research and Evaluation, 1997; Cox, 2005).

Despite the fact that most British Columbians have access to a wide variety of food choices, some disturbing trends are apparent. In 2001, up to 17 per cent of British Columbians experienced food insecurity; more disturbingly, a large percentage of these British Columbians were children. This situation has not improved over the past few years (Ledrou & Gervais, 2005).

In addition, among British Columbians who are not food-insecure, there is good evidence from surveys that a substantial proportion are "malnourished", either through overconsumption of foods that should be consumed in moderation, or underconsumption of nutritious food, or both. The 1999 BC Nutrition Survey showed that 65 per cent of those surveyed were not consuming the minimum of 5 servings of vegetables and fruits, and that 25 per cent of respondents consumed 35 per cent of their total calories from fat. This survey also showed that both food insecurity and malnourishment are associated, though not exclusively, with low-income status (Ministry of Health Planning, 2003).

Earlier, this report showed that the environment is an important factor in nutrition and health, as it can foster and support either healthy or unhealthy choices. The evidence of a preponderance of unhealthy choices points to an "obesogenic", or fat-inducing environment.

Data has shown that improving the nutritional status of British Columbians would result in fewer cancers, less heart disease, lower rates of Type 2 diabetes, and less degenerative joint disease; it may also result in healthier, more active children who do better academically, and overall, a psychologically healthier population. The health care system could do much better in identifying, preventing, and managing food- and diet-related problems—particularly at the primary care level.

Food can also cause illness through contamination from biological, chemical, or physical sources. Hazards can occur at any stage of food production and preparation. Foodborne disease is estimated to have affected over 650,000 individuals in 2003. The cost of food poisoning is estimated to be approximately $988 per individual every year (Ministry of Health, 2005b). Food safety needs to be addressed from "farm-to-fork", and requires a coherent food safety management system.

The broader impacts and sustainability of our global system of food production also need consideration. What are the impacts on the Third World food-producing nations? What

are the costs of "food miles"? How sustainable is intensive agriculture, whether land- or sea-based? Have the benefits or risks of genetic modification been adequately assessed? For most of these issues, opinions differ widely, the science is not definitive, and both emotion and economic interests may colour objectivity.

What We Know...

With regard to food as a social determinant of health, the World Health Organization summarizes our level of understanding as follows:

> *A good diet and adequate food supply are central to promoting health and well-being. A shortage of food and lack of variety cause malnutrition and deficiency disease. Excess intake (also a form of malnutrition) contributes to cardiovascular diseases, diabetes, cancer, degenerative eye diseases, obesity and dental caries. Food insufficiency exists side by side with food plenty. The important public health issue is the availability and cost of healthy and nutritious food. Access to good, affordable food makes more difference to what people eat than health education (Wilkinson & Marmot, 2003, p. 26).*

Social and economic conditions result in a social gradient in diet quality that contributes to health inequalities. The main dietary difference between social classes is the source of nutrients. Having a low income encourages individuals to substitute cheaper processed food for healthy food; as a result, in general, people on a low income are least able to eat well.

Dietary goals to prevent chronic diseases emphasize eating more fresh vegetables, fruits, legumes, and more minimally processed starchy foods, while eating less animal fat, refined sugars, and salt (Wilkinson & Marmot, 2003). We also know that there is a better understanding of the barriers to healthy eating than the efficacy of interventions to improve healthy eating. Common sense suggests that removal of such barriers would be an important step to promoting healthier eating.

What We Need to Know...

Experts in the field of food and nutrition are calling for more rigorous research to understand the factors that influence healthy eating, in order to develop effective strategies to address health status and to inform policies and programs which impact on the health of all Canadians (Frank & Finegood, 2005).

We should ensure that new and existing community-based food security initiatives are accompanied by appropriate and ongoing evaluation. To do this effectively, collaboration between health and social science research is necessary.

The following recommendations are aimed at individuals, communities, business, and governments and are intended to address the issues identified throughout the report.

Steps to Make BC More Food Independent

What can individuals do?

- Buy from local farmers whenever possible, and request more local food at your grocery stores.
- Support the organizations that support local farmers.
- Encourage local and provincial governments to preserve BC's agricultural land base.
- Support retailers and restaurants that are committed to providing local foods.
- Ask local officials to make healthy food an important issue on the local and regional government agenda.
- Ensure a household minimum of a 72-hour supply of non-perishable food and water is available for emergencies.

What can communities do?

- Raise consumer awareness about the importance of buying local foods.
- Explore options for community food programs, and find innovative ways to meet food needs locally such as buying clubs, community kitchens, community gardens and farmers' markets.

- Develop partnerships among organizations, government, and the private sector to meet food needs locally and improve our agri-food system.
- Encourage local and provincial governments to assist farmers with access to land and with supportive legislation and regulations.

What can governments do?

- Ensure a coordinated provincial approach to food independence.
- Make firm policy commitments to protect agricultural land.
- Set policy that encourages government buyers and contractors to purchase locally grown food.
- Collaborate with non-governmental organizations and the private sector to help meet food needs and to improve our agri-food system.
- Explore opportunities to increase the participation of young people in farming.
- Provide educational facilities to increase agricultural education opportunities.
- Provide support through policy, and publicity for urban food production, as well as community and rooftop gardens.
- Offer incentives to retailers to carry food that is produced locally.

Obesogenic Environment

The obesogenic environment has been defined as "the sum of influences that the surroundings or conditions have on promoting obesity in populations" (Swinburn et al., 1999). In 1997, the World Health Organization Consultation on Obesity recommended the necessity for comprehensive public health approaches and strategies for the prevention and management of overweight and obesity (WHO, 2000). These strategies aim to change the physical and social environments responsible for the increasing trends in overweight and obesity by intervention in the following areas:

- Health-promoting school environment
- Public education
- Monitoring and regulation of the marketing approaches of the food industry
- Urban design and transportation
- Data and research

Health-Promoting School Environment

Schools provide an ideal environment for the promotion of healthy eating and physical activity among children and youth. Most children spend six hours a day, five days a week in schools during school season. The years from kindergarten to grade 12 provide a perfect opportunity to target effective health promotion strategies and provide opportunities for physical activity and sports. In addition, the school environment is an ideal setting for providing comprehensive health promotion activities that will enhance physical, social, emotional, and intellectual development. An additional benefit is that children often become message carriers for the entire family, bringing home information about the need for healthy diets, smoking cessation, and physical activity that helps influence change in their family. The

▶ Studies in the Prevention of Obesity Among Children

Reduced television watching:
A randomized controlled trial compared children in two California elementary schools. One group received a 6-month, 18-lesson, classroom curriculum designed to reduce television, videotape, and video game use. After two years, the children who received the intervention had a lower Body Mass Index (BMI), reduced waist-to-hip ratios, and self-reported reduced television watching and fewer meals in front of the television (Robinson, 1999).

Reduced soft drink consumption:
A randomized controlled trial of 644 children age 7 to 11 in 6 primary schools in southwest England focused on reducing soft drink consumption by the children and replacing it with consumption of water, milk, or diluted fruit juice. After 12 months, overweight and obesity had increased by 7.5 per cent in the control group, but had decreased by 0.2 per cent in the intervention group (James, Thomas, Cavan, & Kerr, 2004).

Act Now BC: Provincial Government Initiative for Healthy Living

Act Now BC is a health and wellness initiative launched by the Provincial Government in March 2005 to encourage British Columbians to make BC the healthiest and most physically active jurisdiction to ever host an Olympic Games.

Act Now BC's goal is to promote healthy living choices in order to reduce chronic disease and improve the quality of life and health among the province's citizens; this is to be accomplished by focusing on common risk factors. Coordinated across all of provincial government ministries, ActNow BC is a multi-year, multidisciplinary effort to create policies, programs, and services that will motivate British Columbians to:

- Eat a healthier diet.
- Become more physically active.
- Maintain healthy weights.
- Reduce, quit, or avoid tobacco use.
- Make healthy choices in pregnancy.

ActNow BC involves all provincial government ministries, local governments, schools, employers, communities, and external partners such as the BC Healthy Living Alliance (BCHLA). The BCHLA has the capacity to mobilize more than 40,000 volunteers, 4,300 health and recreation professionals, and government organizations across BC. The BCHLA member organizations include: Heart and Stroke Foundation, Canadian Cancer Society, Canadian Diabetes Association, BC Lung Association, BC Recreation and Parks Association, Dietitians of Canada, Public Health Association of BC, Union of BC Municipalities, the BC Pediatric Society, and the regional health authorities.

Meeting 2010 targets will result in the following:

For Physical Activity...

- 7 out of 10 British Columbians will get enough activity for health benefits.
- An additional 351,000 British Columbians will be physically active.
- Meeting the target would mean at least 1 person in an inactive family of 5 will walk briskly for 30 minutes a day.

For Healthy Eating...

- 5 out of 10 British Columbians will eat at least five servings of fruits and vegetables a day.
- 310,000 more British Columbians will meet the Canada Food Guide Recommendations of 5 to 10 servings of fruits and vegetables daily.
- Meeting the target would mean that everyone will eat one more serving of fruits or vegetables per day.

What will success look like...

- 7 out of 10 British Columbians will be at a healthy weight.
- 349,000 more BC adults will achieve a healthy weight.

The BC Healthy Living Alliance has recently received a $28 million, 5-year grant from the BC Ministry of Health. For more information please see http://www.bchealthyliving.ca/index.php.

knowledge, attitude, and behaviours established in childhood and youth have a direct impact on the lives of individuals in later years. Healthy children will more than likely become healthy adults.

Public Education

Public education is essential in developing comprehensive prevention strategies. Public education and health promotion regarding healthy eating and physical activity are major tools in helping people to choose healthy options. Consumers should be educated and encouraged to choose foods with high nutritional quality and to know the benefits of regular physical activity. It is important to note that public education programs need to be diverse and culturally sensitive to target special groups such as the Aboriginal population. Health care providers should also receive ongoing training to educate, direct, and support behavioural changes in populations.

Monitoring and Regulation of the Marketing Approaches of the Food Industry

The marketing of foods high in fat, sugar, or starch—such as soft drinks, candy, and potato chips—especially to children, is contributing to the high rates of overweight and obesity. Monitoring and regulating the marketing approaches adopted by the food industry could be an important strategy in preventing overweight and obesity in the population.

Regulating nutrition information provided by food manufacturers is a strategy to help people make informed food choices. Recently Health Canada introduced regulations that require mandatory labelling of nutritional information in most prepackaged foods sold in Canada. These new regulations require manufacturers to

provide nutritional information in a consistent way on their food products, and permits diet-related health claims for food (Canadian Institute for Health Information, 2004).

Urban Design and Transportation

Research has shown a link between urban design and physical activity and obesity. Communities that are designed within walking distance to shops and businesses tend to have lower rates of obesity. It has been shown that recreation facilities, trails, and safe bicycle lanes will encourage people to be active, while decentralized, low-density residential development, and the growth of highways and freeways, will discourage it. Community planning and design is an important potential feature of policy that will promote physical activity and reduce obesity (Frank, Andresen, & Schmid, 2005).

Data and Research

Effective policy decisions generally depend on reliable and good quality population-level data. For prevention programs to be successful, a review of existing data sources is required and data gaps need to be identified. A recent partnership between Health Canada and Statistics Canada to conduct the nutrition component of the Canadian Community Health Survey has resulted in more accurate data and information on food and nutrient intakes.

Research is also an important tool for making policy decisions. Evaluating the effectiveness of programs and policies is a key research objective to support future policy development (Canadian Institute for Health Information, 2004).

Many areas of research related to obesity and physical activity still needs to be explored. Although a link between community-based interventions and activity levels has been established, we still need to explore the link between community-based interventions and obesity. We also now know that there is a relationship between urban design and obesity; however, we still do not completely understand the cause and effect nature of the relationship.

More research, analysis, and evaluation is also needed on the cost-benefit of programs related to promoting healthy eating and physical activity in the workplace.

BC School Initiatives on Promoting Healthy Eating and Increasing Physical Activity

The following school-based initiatives are funded under the ActNow BC program.

Action Schools! BC
Action Schools! BC is a best practices model designed to assist schools in creating individualized action plans to promote healthy living through a comprehensive school approach.

Guidelines for Sales of Food and Beverages in BC Schools
These guidelines, developed as a partnership between the Ministry of Education and the Ministry of Health, are designed to maximize students' access to healthier options. The province's goal is to eliminate the sale of unhealthy foods and beverages in BC schools by 2009. Supporting materials have been developed for local implementation. For more information, please refer to the website at http://www.bced.gov.bc.ca/health/health_publications.htm.

School Fruit and Vegetable Snack Program
This pilot project in ten schools provides twice-weekly BC fruit or vegetable snacks to elementary students, as well as information to teachers, students, and their families to increase awareness and consumption of BC fruits and vegetables in the school community.

Making It Happen – Healthy Eating at School
This initiative is a solution-oriented, web-based toolbox of resources to inspire school communities in British Columbia to take action on nutrition policy and practices that affect youth. This initiative won the Speaking of Food and Healthy Living Regional Award through the Dietitians of Canada.

Rails to Trails
A program involving conversion of abandoned rail grades to recreation corridors; this program has helped to improve health and enhance communities as well as benefiting the economy in British Columbia. Examples of this project include the Kettle Valley Railway Trail in Hope and the Galloping Goose Trail in Victoria.

Creative Use of School Space
Use of under-utilized spaces in schools for activities such as physical activities, youth drop-in centres, and other programs to promote wellness in the community.

As of July 31st, 2006, 943 schools have participated in BC school initiatives.

Forum on Childhood Obesity
March 2005
Vancouver, British Columbia

On March 3-4, 2005, a selected group of leaders from a variety of sectors gathered in Vancouver to review the extent and the implications of childhood obesity and to examine the evidence for effective prevention. The objectives of the forum were to extend the partnerships and integration of initiatives, to promote and foster research in prevention and management of obesity, and to address the issue of obesity in British Columbia in the context of chronic disease prevention and healthy living. The six recommendations suggested for provincial action were:

Social marketing
An orchestrated, sustained, and consistent information campaign needs to take place to promote effective and proven steps to reduce obesity. These will include minimizing soft drink intake, limiting screen time to less than two hours per day, and encouraging breastfeeding for the first six months of life. Eating at least five daily servings of fruits and vegetables and increasing physical activity are also recommended.

Promoting healthier neighbourhoods and communities
New legislation and amendments are needed to make health impact assessments mandatory for all new developments. Bicycle lanes and walking paths, sidewalks, easier access to healthy foods with reasonable prices, and better public transportation are some of the changes that can be made to make neighbourhoods and communities healthier.

Support and enhance comprehensive school programs
BC's acclaimed Action Schools! BC program needs to continue. This program promotes increased physical activity, nutritious eating, and other healthy policies. The program has shown promising results.

Inventory of services
Health authorities must ensure that each region provides an inventory of all the programs and services that can help families adopt healthier eating habits and participate in physical activity.

Make healthy weights and regular physical activity part of early chi¹dhood development goals
Regulations should be in place to ensure that all daycares and preschools adhere to guidelines for healthy eating and regular physical activity. The early years of a child (before age six) are crucial for diet and physical activity standards that need to be established and supported.

Create obesity assessment and treatment centres
Health authorities need to have assessment and treatment centres that are based on best practice models to help obese children and their families to access effective treatment and counselling programs.

Steps to Address the Obesogenic Environment

What can individuals do?

- Eat a healthy diet – A diet low in saturated fat and sugar and high in complex carbohydrates and dietary fibre, such as one with fruits, vegetables, and whole grains, is strongly recommended for promoting overall health.
- Increase physical activity – Regular physical activity not only burns calories and prevents weight gain, it can also delay or prevent many serious illnesses and chronic conditions. Physical activity is also known to improve sleep, increase energy levels, and help reduce stress, anxiety, and depression.
- Maintain healthy weights – Individuals can prevent or reduce obesity by maintaining a healthy weight through increasing physical activity and eating a healthy and balanced diet.
- Support and advocate for policies promoting community food security – Organize or be a part of initiatives to ensure access to affordable and healthy foods by the whole community.

As parents, individuals can:

- Breastfeed babies and support breastfeeding mothers.
- Be a role model for their children by adopting healthy eating habits and regular physical activity.
- Limit children's "screen time" to increase their physical activity.
- Support the monitoring and regulating of marketing approaches by the food industry.
- Monitor children's television viewing to reduce their exposure to unhealthy food advertising.

What can schools do?

- Make physical activity mandatory up to grade 12.
- Provide healthy snacks and meals in schools.
- Ban unhealthy foods and drinks and replace them with healthy foods and drinks.

What can communities do?

- Promote healthy eating and healthy weights.
- Encourage physical activity and provide affordable recreational facilities. Neighbourhoods need to have access to clean and safe parks and walking paths, safe bicycle lanes, and other facilities.
- Make walking and biking more attractive by requiring that new developments or re-developments create more mixed land use and higher densities with higher connectivity to amenities that people need to access.
- Develop and support programs such as community kitchens and gardens.
- Develop healthy food policies within their communities to ensure access to healthy foods for all people regardless of their income or individual resources.

What can industry and businesses do?

- Support the community initiatives to promote healthy eating and physical activity.
- Ensure sales, marketing, and employment policies promote healthy eating and physical activity.
- The hospitality industry should develop marketing practices that support healthy eating.
- Support health promotion at the workplace (e.g., exercise shower facilities for employees who run or cycle to work, provide healthy foods at meetings, etc.).
- Businesses should encourage baby-friendly practices and provide appropriate places for breastfeeding.
- The food industry should cease advertising of unhealthy foods to individuals, particularly children, and change their focus to healthier foods.
- Comply with the recommendations of the Trans Fat Task Force on eliminating trans fats, particularly the following:

  The total trans fat content for all vegetable oils and soft, spreadable margarines sold to consumers or used as an ingredient in the preparation of foods on site by retailers or food service establishments should be limited to 2 per cent of total fat. The total trans fat content of all other foods should be limited to 5 per cent of total fat content (Health Canada, 2006).

What can physicians and health care professionals do?

- Encourage healthy eating and healthy weights and provide appropriate treatments for both parents and children with unhealthy weights.
- Educate their patients to prevent and reduce obesity. Strategies should involve and empower patients to participate in behaviour modification and management of their disease.
- All health care providers should be aware of resources in their community so that they can support and educate their patients in healthy eating and active living.
- Ensure breastfeeding is promoted and that hospitals follow World Health Organization guidelines for proper breastfeeding practices (WHO, 2003b).

Obesity and Our Living Environment

A recent study has shown a strong link between driving and obesity. The study showed that every additional 30 minutes individuals spend driving in a car can result in a 3 per cent greater chance of obesity. This study also showed that people who lived in neighbourhoods within walking distance to shops and businesses were 7 per cent less likely to be obese.

The study tracked the Body Mass Index (BMI) of more than 10,500 people in Atlanta, as well as assessing their living environment. The results showed that community design was the most important factor for obesity. Factors such as high connectivity of the street network and alternative routes, as well as higher residential density, proved to have a beneficial effect on BMI and reduced the probability of obesity (Frank et al., 2005).

What can governments do?

- Continue to support obesity prevention as a key public policy that spans across ministries and departments beyond the Ministry of Health.
- Support ActNow BC as a mechanism for increasing food security, reducing obesity, and encouraging healthy eating and active living. Programs such as ActNow BC need effective and sustained support over a long period to make a difference in prevention of obesity and other chronic diseases.
- Adjust income supports to link with the cost of healthy eating.
- Investigate ways to reduce the cost of food in lower-income communities.
- Governments and Regional Health Authorities should invest in chronic disease prevention and management through team-based approaches on health care, using anticipatory care and linked databases and record systems.
- Monitor and regulate the marketing approaches adopted by the food industry.
- Continue to support food security as a core public health program.
- All levels of government should commit to a healthy eating and food security strategy.
- Encourage policies at the federal, provincial, and municipal levels for a safe, secure, and sustainable food supply.
- Encourage development of local food policy and programs.
- Support the evaluation of healthy eating programs from birth to advanced years to ensure that policy and decision-making for programs are based on solid evidence.
- Municipalities should encourage urban design that encourages safe walking, biking, and public transit to encourage physical activity as well as reducing dependence on gasoline-powered transportation.
- Support health promotion in the workplace.
- Support more research on low-income populations in the province and by region to discover the most successful interventions regarding access to healthy food.

Gaps in Data and Research

While we are confident in making the above recommendations, data and research gaps still remain. In these regards, the 2004 Canadian Institute for Health Information Report, *Improving the health of Canadians* posed the following questions:

- What are measured height and weight and the resultant BMI of people and how well do they correspond to self-reported BMI?
- What are the relative contributions of physical activity and diet to observed trends?
- What the social, environmental and economic factors underlying the current obesity trends?
- What are bodyweight trends among Aboriginal Canadians?
- Why are residents of certain provinces and regions less physically active and why do some have less healthy eating patterns?
- What are the actual impacts on obesity prevalence of preventive policies and programs that improve diets and increase physical activity?
- Which preventive policies and programs work best? (CIHI, 2004)

In addition, the 2005 Integrated Pan-Canadian Healthy Living Strategy Report identified the following 3 strategies for gaps in data and research:

- Increase capacity for knowledge development and exchange to promote healthy eating, physical activity and their relationship to healthy weights.
- Increase Population-level intervention research to understand and address the determinants of healthy eating, physical activity and their relationship to healthy weights.

- Implement an integrated system for knowledge development and exchange regarding policies and programs in the health and "non-health" sectors (Intersectoral Healthy Living Network, 2005).

Steps to Address Food Insecurity for Persons with Lower Socio-Economic Status

What can individuals do?

- Support and advocate for policies to promote community food security that would ensure the entire community has access to nutritious and healthy foods.
- Participate or support community kitchens and other community food initiatives.
- Provide support to make food security for low-income families a priority.
- Support local school boards to provide healthy school meal programs.
- Organize or participate in food policy councils.

What can communities do?

- Support and organize community food programs, such as community kitchens or food boxes, for low-income households.
- Support and initiate community affordable housing in order to improve the ability of low-income people to meet food needs.
- Support and/or implement education and empowerment-oriented community food programs.
- Create or support local food policy councils.

What can governments do?

- Ensure that income assistance rates are based on the actual cost of living.
- Base the food allowance on the actual cost of a nutritious food basket, with an increase over time in accordance with the cost of food.
- Work with school boards to ensure school meal programs are available in a dignified manner, to all children in need.
- Continue to support community food awareness and food action initiatives through sustained funding for initiatives such as ActNow BC and the Health Care Leaders' Association of BC.
- Support proposed developments to provide affordable or mixed income housing.
- Support local farmers' markets where they currently exist, and encourage their development in neighbourhoods that have limited access to healthy local products.
- Continue to fund and support targeted programs for at-risk populations such as high-risk pregnant women, seniors, and Aboriginal groups.

Steps to Address Food Insecurity and Healthy Eating in the Aboriginal Population

Most indigenous populations worldwide, including the Canadian Aboriginal population, share a pattern of increased illness and mortality compared to other BC residents. The key considerations are a long history of colonization, cultural deprivation, political impotence, and systematic discrimination as well as genetics, lifestyle, socio-economic factors, poor quality housing and community environments, unemployment, and low levels of education. Some researchers have focused on the role of genetics as a risk factor for adverse health outcomes and suggest that in the Canadian Aboriginal population, the gene-environment interaction may be particularly strong (Cass, 2004). The "thrifty gene hypothesis" suggests that some populations developed strong biological mechanisms for conserving energy as fat to enable their survival in times of periodic famine. Some researchers have argued that the impact of the thrifty gene is particularly evident among Aboriginal populations who have made the rapid social transition from active hunter-gatherers to sedentary consumers (Canadian Institute for Health Information, 2004; Young, et al., 2000).

In British Columbia, the Aboriginal population has higher incidence and prevalence rates of chronic diseases, such as Type 2 diabetes, compared to the rest of the BC population; these higher rates are directly linked to the issues of

Assessing Fish Farms in BC

An all-party committee from the Legislature will be touring BC in the summer of 2006 to assess the state of fish farming in BC. The Special Committee on Sustainable Aquaculture will hold public hearings in over 19 communities, beginning in Nanaimo on June 5, 2006. The committee is mainly interested in issues that are important to the people in the communities and is due to report back to the legislature no later than March 2007 (Rud, 2006).

overweight and obesity. Traditionally, the Aboriginal population had access to their own nutritious foods and were much more active. A combination of a change from the traditional diet to one high in starch and sugar, and a change to a sedentary lifestyle, may be responsible for the increase in obesity rates and high prevalence of chronic diseases among the Aboriginal population. The following changes are recommended to prevent obesity and related chronic diseases:

The government and the people of BC should work to:

- Ensure healthy and affordable foods are available to Aboriginal communities (First Nations, Metis, and Inuit).
- Support the possibilities of local food production.
- Ensure government policies support communities interested in a re-introduction of traditional diets or their equivalent.
- Make neighbourhoods safe for families and children to be physically active.

The following recommendations from the 2001 Provincial Health Officer's Report, *The Health and Well-being of Aboriginal People in British Columbia*, are also important in this context:

- Improve housing conditions and economic and educational opportunities for Aboriginal people.
- Increase awareness of the health status of Aboriginal people and the health issues and challenges that Aboriginal people face.
- Pay more attention to the non-medical, cultural, and spiritual determinants of health. Encourage participatory research to gain a clearer understanding as to why some Aboriginal communities are "healthier" than others.
- Support efforts by Aboriginal people to achieve self-determination and a collective sense of control over their futures, in both on- and off-reserve communities.
- Encourage greater Aboriginal participation in the governance, design, and delivery of culturally appropriate health services.

Steps to Address Food Safety

What can individuals do?

- Choose foods processed for safety, i.e. pasteurized products over unpasteurized.
- Cook foods thoroughly. Use a meat thermometer to ensure that the internal temperature reaches at least 71° C (160° F) for ground beef and meat and 74° C (165° F) for poultry (BCCDC, n.d.).
- Store cooked foods promptly and carefully.
- Reheat cooked foods thoroughly.
- Do not allow any contact between raw food or its traces and cooked food.
- Wash hands repeatedly.
- Keep all kitchen surfaces clean.
- Protect food from insects, rodents, and other animals.
- Use safe water.

What can communities do?

- Encourage all food handlers to obtain the FOODSAFE certification course.
- Encourage all food handlers to get hepatitis A vaccinations to prevent outbreaks in the community.

What can industry, governments, and agencies do?

The food production and distribution system is complex and involves many participants and all levels of government. The present food safety system has gaps and inconsistencies and needs to be better coordinated. Essential elements of a modernized food safety management system could include the following:

- A clear definition of roles and responsibilities for all key partners in accomplishing the objectives of the provincial management strategy.
- Implementation of surveillance systems which effectively monitor and identify existing hazards throughout the food continuum, and which can also serve as an early warning system for emerging trends and diseases.
- Development of strategies for best practices to ensure BC's food industry is in line with nationally and internationally recognized food safety systems such as Hazard Analysis and Critical Control Point (HACCP).
- Development of crisis preparedness response protocols and agreements to ensure provincial preparedness in the event of emergencies affecting the food supply.
- Support for the implementation of food safety as a core public health program.

Royal Society of Canada Recommendations on Genetically Modified Foods (2001)

- Approval of new transgenic organisms for environmental release, and for use as food or feed, should be based on rigorous scientific assessment of their potential for causing harm to the environment or to human health.
- Design and execution of all testing regimes of new transgenic organisms should be conducted in open consultation with the expert scientific community.
- New technologies should not be presumed safe unless there is a reliable scientific basis for considering them safe. The Panel rejects the use of "substantial equivalence" as a decision threshold to exempt new genetically modified products from rigorous safety assessments on the basis of superficial similarities because such a regulatory procedure does not adequately protect people or the environment.
- Those who would deploy biotechnical products should assume the primary burden of proving their products safe, and should be required to carry out the full range of tests necessary to reliably demonstrate safety.
- Where there are scientifically reasonable grounds to suspect the possibility of serious harms to human health, animal health, or the environment, the lack of proof of such harms should not be considered proof that they are safe. They should be treated as potentially harmful until their safety level is established.
- The prospects of serious risks to human health, of extensive, irremediable disruptions to the natural ecosystems, or of serious diminution of biodiversity demand that the best scientific methods be employed to reduce the uncertainties with respect to these risks. Approval of products with these potentially serious risks should be withheld until their safety level can be measured.
- Conservative safety standards with respect to certain kinds of risks (e.g., potentially catastrophic) should be used. When "substantial equivalence" is invoked as an unambiguous safety standard (and not as a decision threshold for risk assessment), it stipulates a reasonably conservative standard of safety consistent with a precautionary approach to the regulation of risks associated with genetically modified foods.
- Canadian regulatory agencies and officials should exercise great care to maintain an objective and neutral stance in their public statements and interpretations of the regulatory process with respect to the risks and benefits of biotechnology.
- Canadian regulatory agencies should seek ways to increase the public transparency of the scientific data and the scientific rationales of their regulatory decisions.
- Approvals of genetically engineered products should be based on risk assessments performed by an independent, peer-reviewed, non-governmental system that is supported by regulatory agencies. The data and the rationales upon which the risk assessment and the regulatory decision are based should be publicly available.
- The Canadian Biotechnology Advisory Commission should undertake a review of the problems related to the increasing domination of the public research agenda by commercial interests, and make recommendations for public policies that promote and protect fully independent research on the health and environmental risks of agricultural biotechnology.

Working Towards Change...

Health cannot be separated from environmental and societal influences surrounding the individual. Facing epidemics of obesity and chronic illness, governments need to strive to create environments that make the healthy choice the easy choice. We cannot expect people to make healthy choices when they live in unsupportive social and physical environments. It is therefore necessary to work towards creating a positive and healthy social, nutritional, and physical environment where people can have access to healthy and safe food, and can take part in physical activity that will allow them to live healthier lives.

- With respect to the current concerns over avian influenza, government and the poultry industry should monitor the safety standards of industrial poultry farming with measures that include surveillance, bio-security, and de-concentration of the industry for safety and sustainability.
- Endorse the Royal Society of Canada's recommendations on genetically modified foods.
- Labelling should be provided on all genetically modified foods to allow for consumer's choice.
- The Canadian Food Inspection Agency should implement intensive and extensive monitoring of Canadian foods for metals (e.g. lead, mercury), organic pollutants (e.g. PCBs), and other contaminants of potential concern. The results of such monitoring should be made available to public health officials and the public to provide a good evidence base for risk assessment, risk management, and healthy eating.

Appendix A: Technical Terms, Methods, and Statistical Computations

(provided by BC Vital Statistics Agency)

Age-Standardization

Age-standardized is a method of calculation that adjusts a statistical measure for differences in the age/gender structures between populations. With standardized measures, more meaningful comparisons can be made between genders, different time periods, or geographic areas, because the age-standardized statistic is calculated as if all populations had the same age/gender population distribution.

Age-Standardized Mortality Rate (ASMR)

A summary of age adjusted death rates by age and gender, which have been standardized to a 'standard' population (1991 Canada Census) for the purpose of rate comparisons between genders, different time periods or different geographic locations. The ASMR is the theoretical number of deaths that would occur per 10,000 population, if the specific population had the same age structure as the standard population.

Potential Years of Life lost (PYLL)

The number of years of life lost when a person dies before a specified age (75 years). The PYLL Standard Rate (PYLLSR) is an age-standardized measure of an area's PYLL, expressed in terms of rate per 1,000 population, adjusted to a standard population (1991 Canada Census).

Standard Population

A reference population of known age distribution used in the calculation of standardized indicators to adjust for variations in population age structures in different geographic areas or time periods. For SMR and PYLL calculations the standard population is the British Columbia population for the year(s) concerned. The 1991 Canadian Census is used as the standard population in the calculation of ASMR and PYLLSR.

Statistical Computations

The next two pages provide the reader with computational examples of how various measures are calculated. In the examples, LHAs have been employed as the geographic unit of analysis. All data shown in the examples are hypothetical.

Age Standardized Mortality Rate (ASMR)

		LHA		
Age Group	Standard Population	Estimated Population	Death Rate/10,000	Observed Deaths
(i)	(n_i)	(p_i)	(m_i)	(d_i)
<1	403,061	1,339	22.4	3
1–4	1,550,285	5,483	1.8	1
.	.	.	.	.
.	.	.	.	.
.	.	.	.	.
80–84	382,303	1,198	701.2	84
85+	287,877	908	1596.9	145
TOTAL	28,120,065	81,016		561

For the Local Health Area:

$$ASMR = \frac{\Sigma m_i \times n_i}{\Pi} = \frac{22.4 \times 403{,}061 + \ldots + 1{,}596.9 \times 287{,}877}{28{,}120{,}065} = 46.2$$

Where: p_i = area population in age group i;

n_i = standard population in age group i;

$\Pi = \Sigma n_i$ = total standard population;

d_i = deaths in LHA population in age group i; and

$m_i = d_i / p_i \times 10{,}000$ = mortality rate per 10,000 LHA population in age group i.

e.g., $m_i = \frac{3 \times 10{,}000}{1{,}339} = 22.4$, for age group 1.

Potential Years of Life Lost (PYLL) and Standardized Rate (PYLLSR):

			LHA			
Age Group (i)	Age Factor ($75-Y_i$)	Standard Population (π_i)	Estimated Population (p_i)	Death Rate/10,000 (m_i)	Observed Deaths (d_i)	Observed PYLL ($d_i(75-Y_i)$
<1	74.5	403,061	1,339	2.2	3	223.5
1–4	72.0	1,550,285	5,483	0.2	1	72.0
5–9	67.5	1,953,045	6,553	0.2	1	67.5
.	.	.	.	.	.	.
.	.	.	.	.	.	.
.	.	.	.	.	.	.
65–69	7.5	1,084,588	3,538	18.7	66	495.0
70–74	2.5	834,024	2,779	28.8	80	200.0
TOTAL 0-74		28,120,065	79,140		239	3,183.0

For the Local Health Area:

$$PYLL = \Sigma d_i \times (75 - Y_i)$$

Where: d_i = number of deaths in age group i;

Y_i = age at midpoint of age group i; and

Σ = summation.

$$PYLLSR = \frac{\Sigma m_i \times \pi_i \times (75-Y_i)}{\Pi} = \frac{22 \times 403{,}061 \times 74.5 \ldots + 28.8 \times 834{,}024 \times 2.5}{28{,}120{,}065} = 37.0$$

Where: p_i = LHA population in age group i;

π_i = standard population in age group i;

$\Pi = \Sigma \pi_i$ = total standard population;

d_i = deaths in LHA population in age group i;

Y_i = age at midpoint of age group i; and

$m_i = (d_i / p_i) \times 1{,}000$ = mortality rate per 1,000 LHA population in age group i.

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Appendix C:
Health Authorities and Health Service Delivery Areas in BC

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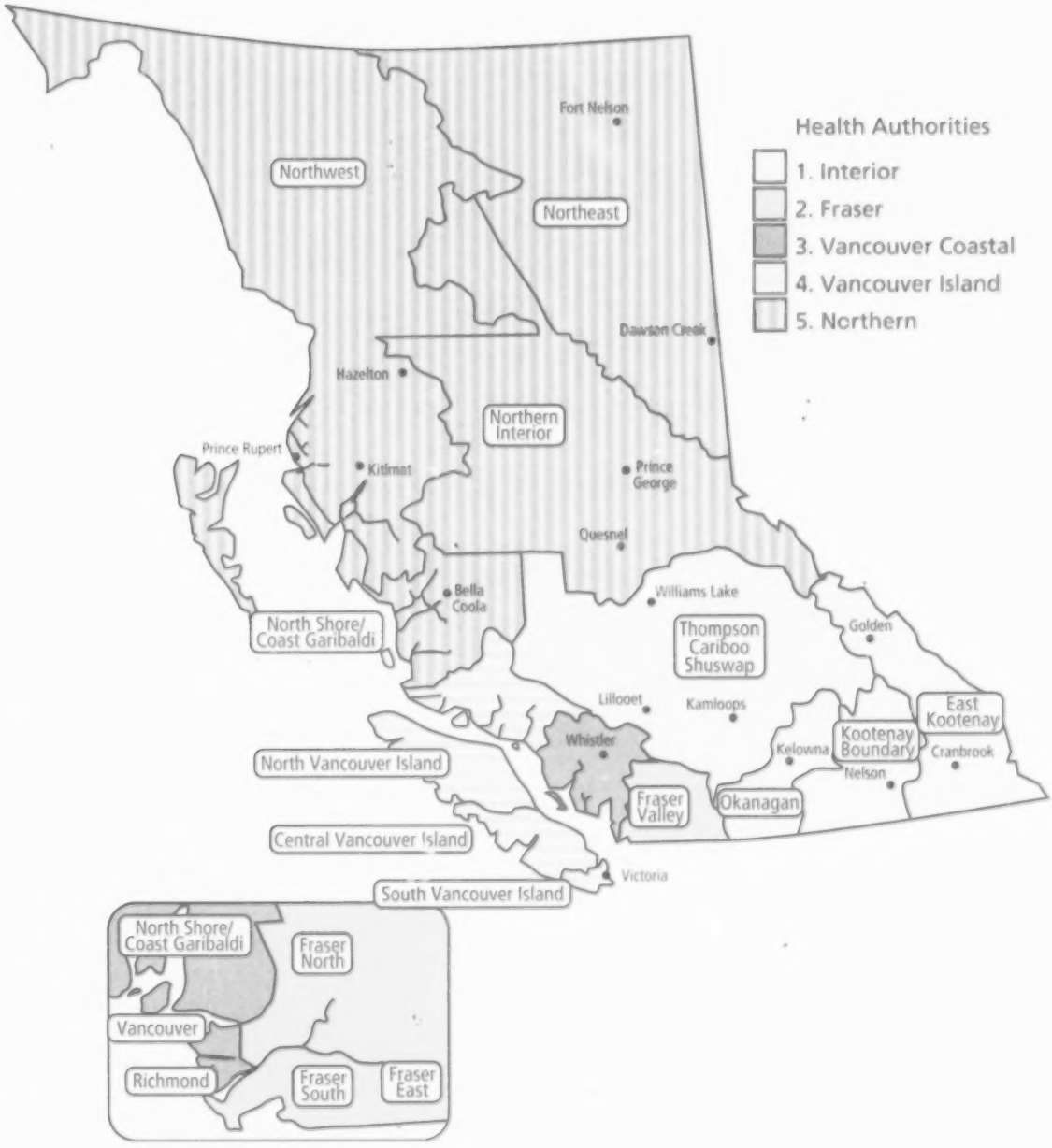

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